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ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LVI

JANUARY TO DECEMBER, 1953

NUMBERS 1-6



INSTRUCTIONS TO BINDER

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Bulletin of the
New York
Zoological Society

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FEBRUARY

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

An Ocean of Opportunity

THE LARGEST and wealthiest city of the Western World needs a great Aquarium. Its absence represents a serious void in the recreational and educational facilities of New York. Our Society is the fore-ordained medium through whose efforts, in partnership with the City government, this new project can be brought into existence. Consequently it is our purpose to do everything within our power to accomplish this.

The history of our Society has been that of endeavoring to provide a better understanding of the living things of the world. Now, at the mid-century, this present great opportunity lies before us. We can be conscious of the fact that the trend of modern society is to become urbanized and consequently to be removed from the mysteries and wonders of nature. We need to recognize that many, many people, living in these days of modern civilization, are deprived of contact with the natural world around us. Yet the yearning of the individual for this other world is undiminished.

To meet that very real need is no easy task. Our part of the total cost of construction and opening expenses of a new Aquarium is \$5,000,000. In this connection, it might be observed that money, like everything else, is relative. Each year equally great or even greater sums are invested in other types of public-serving institutions, all of which are valuable but none of which is unique in the sense that, while we have great museums, hospitals and universities, they do not parallel the highly individual values of an aquarium.

Working together, one and all, we can fulfill this further purpose, which can become another epic in the history of our Society.

Fairfield Osborn

THE TIMELESS TUATARA

By JAMES A. OLIVER

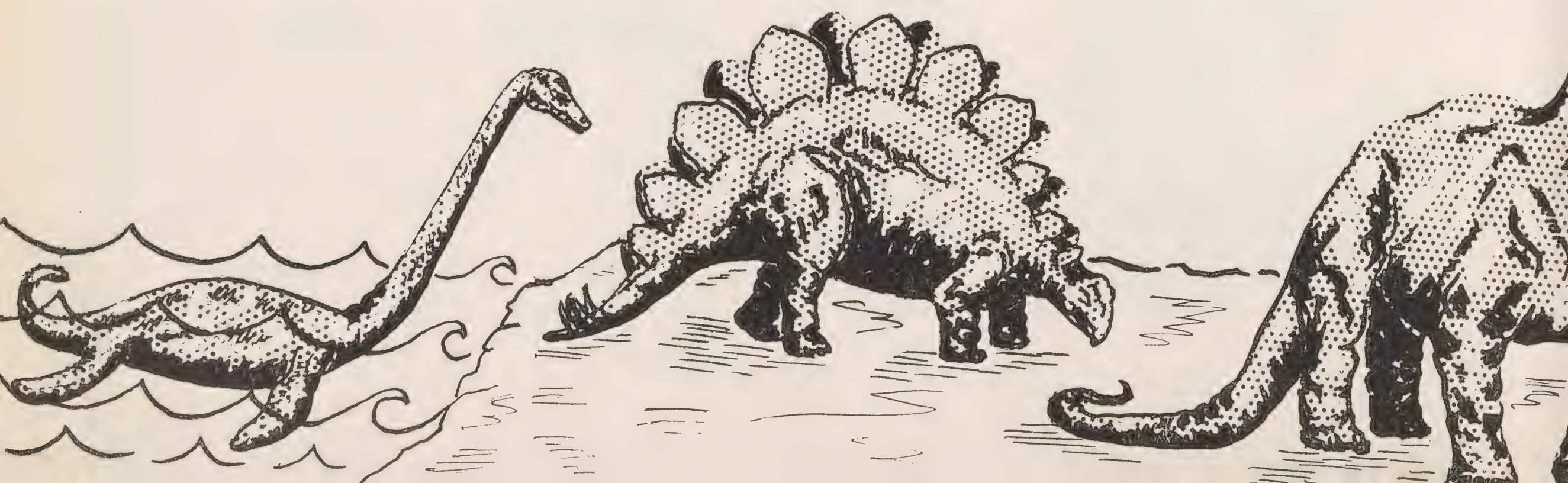
IF WE COULD BORROW a time machine from some modern genius of the comic-strip world, it would be an exciting experience to travel backward through the millions of years of earth history. Those of us who are interested only in human history would not have to make a very long trip to cover the full span of man's relatively brief age. As measured on the geological time scale of earth history, he is a mere upstart compared with many other forms of life and this trip would require only one million years in time.

Those of us with biological interests who would like to travel farther back into the history of the earth would have to take along a paleontologist (student of fossil animals) to identify the unfamiliar, often bizarre, forms of life that we might see. As we go farther back in time we encounter fewer animals that are familiar to us and more that are strange in appearance. If we were to take a really long trip of this sort with our paleontologist guide, we would find that the various periods of earth history are characterized by differences in the relative numbers, as well as the types, of animals in the major groups. In the long years from the present to about seventy million years ago, we find that mammals are the dominant vertebrate animals living on the land. Some of these look familiar to us, but many look strangely unlike any mammals living today.

As we start on this trip we might see such familiar forms as the horse, the camel and the elephant, but as we go farther along it is necessary for our guide to name more and more of the animals that we see. We are astounded to see what the ancestors of our horse, camel and elephant look like as we approach the early part of this age. Without the assurances of our paleontologist, we surely would not recognize them as having any relation to our modern forms. Because of the predominance of mammals at this time, the paleontologist refers to this as the Cenozoic Era or the Age of Mammals. Other forms of vertebrate life, such as birds, reptiles and amphibians, are present but these do not compare with the mammals in variety or numbers.

Continuing on our journey back through the years we pass from the Age of Mammals into the Age of Reptiles. This period of time marks a point in earth history when reptiles are the dominant forms of life on the land. The Age of Reptiles, or the Mesozoic Era as the paleontologist calls it, begins almost 200 million years ago and ends about 70 million years ago. During its span of over 120 million years, reptiles as a group are the flourishing forms of animal life. Many are of such size and peculiar shape that they challenge our credulity.

The living reptiles of our own time are but a small remnant of the host that lived



during the Mesozoic Era. Today we have only four main lines of reptile life, whereas during the Age of Reptiles some fifteen different lines are known. Some forms are small and not too unlike our living reptiles in outward appearance. Others are completely unlike anything we see today in the Zoological Park's Reptile House. Thus we might see large flying Pterosaurs, some of which have a wing spread of up to twenty-seven feet; streamlined, fishlike Ichthyosaurs; odd-looking Plesiosaurs that have been described as "a snake strung through the body of a turtle;" and a vast array of dinosaurs, varying from small lizardlike forms to the plated, spiked-tailed Stegosaurs, the three-horned Ceratopsians, the carnivorous Theropods, including giants of fifty feet in length that are the largest meat-eating animals that have ever lived on land, and the long-necked, long-tailed, Sauropods seventy to eighty feet long.

The Mesozoic Era is subdivided by the geologist into three time periods—the Triassic from approximately 190 to 155 million years ago, the Jurassic from about 155 to 120 million years ago, and the Cretaceous from around 120 to 70 million years ago. The Cretaceous Period is the time at which the reptiles reached their zenith, both in variety of types and in maximum size attained. At the beginning of the Age of Reptiles, in the Triassic Period, most of the reptiles were of small to moderate size and many looked superficially much like some of our present day lizards. However, we would see no true lizards, or snakes either, at the beginning of the Age of Reptiles.

One of the groups of small, lizardlike reptiles that we might see at the beginning of the Mesozoic includes the members of the Order

Rhynchocephalia, or "Beak-heads," so-called because of the overhanging, beaklike construction at the front of the upper jaw. Some of the Beak-heads are only five inches in length and appear so much like lizards that we would have to examine their internal skeletal structure to be sure that they are not lizards. The paleontologist tells us that this group of reptiles attained its peak of differentiation early in the Age of Reptiles and experienced a progressive decrease from the Triassic to the Cretaceous. Thus they reached their prime and were dwindling away before the majority of reptile lines came into prominence.

One of the puzzling problems with which the paleontologist concerns himself is the strange disappearance of so many of the impressive lines of reptilian development about 70 million years ago at the end of the Mesozoic Era. Many unanswerable questions arise when one contemplates the history of the reptiles. Of the fifteen or more different reptilian lines that existed during the Age of Reptiles, only four are now living. Why did some of these lines survive and others die out? What caused the disappearance of so many of the reptiles at about the same time? These and many other questions relate to the great reptiles of the Mesozoic. We do not know the answers to these questions, but it is fascinating to study the variation in the group in past ages, and a trip similar to the one we have contemplated would indeed be an exciting experience.

From its vantage point as a living reptile, a Tuatara looks back more than 100 million years to the time when reptiles flourished and some 15 different lines of development were extant.



But since such a trip is pure fantasy, we must be satisfied to read books that describe the animals of the different geological ages, or better still, to visit a large natural history museum and view the remains and reconstructions of some of the fascinating life of the past. For those of us who are fortunate enough to do so, a trip to the museum is the nearest thing to an actual journey into the past that we can have — to see the actual remains of past life and hence to know that such things did exist. As the student of human history is delighted at seeing a Mayan figurine, a vase from Pompei, or an early American musket, so the student of biology is eagerly interested to see the fossil remains of animal types that are no longer living.

The paleontologist, through his detailed study of these remains, is able to infer a great deal about the characters and ways of past life. In the case of the backboned or vertebrate animals, the fossil remains consist primarily of the hard bony structures, the skeleton. Occasionally some scale prints, claws, horns or hard armor structures provide additional detail, but he must deduce a great deal from careful examination of the skeleton alone. His knowledge of past forms is complemented by the comparisons that he can make with the structure and habits of living forms.

Dr. Edwin H. Colbert, Curator of Fossil Reptiles and Amphibians of the American Museum of Natural History and author of "The Dinosaur Book," has generously supplied information about the fossil Beak-heads. From his studies of the fossil record, Dr. Colbert finds that at the beginning of the Age of Reptiles, during the Triassic Period, there were some twenty-one different genera in the Order Rhyncocephalia. These occurred in Africa, Asia, Europe, North America and South America. In the Jurassic Period the number of known genera had dwindled to eight, living in Europe and North America. In the last period of the Mesozoic, the Cretaceous, when most reptile lines were reaching their peak, there is but a single known fossil genus of Beak-heads. From the end of the Cretaceous to the present time there is not a single fossil form known. Yet the order did not become extinct, for a single member remains in the island sanctuary of New Zealand, the sole survivor of a group that was old when the dinosaurs were young.

This relic of the Mesozoic Era is the Tuatara, a lizardlike reptile of modest proportions and appearance. It is known by the scientific name of *Sphenodon punctatus* Grey. The common name, "Tuatara," comes from the Maori and means "bearing spines," an allusion to the row of spine-like scales along the midline of the neck, back and tail. These spines are not stiff, but are soft and can be raised when the animal becomes excited. The Tuatara attains a maximum total length of 30 inches. It lives in short burrows, often sharing these with small petrels. The reptile is active chiefly at night, when it seeks out the organisms on which it feeds. These latter include earthworms, snails, slugs, various types of insects, and small vertebrate animals. The food is stalked slowly and grabbed with a sudden lunge. In the daytime, the Tuatara may be seen at the mouth of its burrow. Because it frequently remains immobile for long periods, it is said to be very sluggish. It is reputed to live for long periods of time, but the exact life span is not known.

After the Tuatara was first discovered by scientists in 1831 it was believed to be a lizard, and it was not until a number of years later that its true relationships were known. *Sphenodon* differs from lizards in a number of details of its skeleton, particularly in the skull. In the photograph showing an upper view of the skeleton, an arrow indicates the bony bar that forms the lower border of the lateral temporal opening of the skull. This bony arch gives added rigidity to the hind portion of the skull and prevents movement of the quadrate bone on which the lower jaw articulates to the upper jaw. All lizards lack this lower bony arch and usually have a movable quadrate bone to which the lower jaw is attached. This allows for greater movement in the lower jaw.

The teeth of the Tuatara also merit mention. Those of each jawbone appear to be fused together and to be closely united to the edge of the bone, thus giving the impression of a saw-blade rather than a series of individual teeth. The teeth at the front of the upper jaw are firmly fused with the turned-down premaxillary bone and together have the appearance of large chisel-like incisor teeth in mammals. At the rear of the upper jaw, a series of smaller teeth is pres-



ent on the inner side of the upper jaw teeth. When the mouth is closed, the teeth of the lower jaw fit snugly between these two rows of teeth on each side. This tooth arrangement, together with the rigidity of the jaw articulation, forms an efficient shearing mechanism.

In addition to the skeletal peculiarities, only a few of which are mentioned here, the Tuatara possesses other attributes that make it unique among living reptiles. For example, it is the only modern reptile in which the male has no copulatory organ. As in birds, mating is accomplished by cloacal contact between the sexes. The physiological processes of this reptile are vastly slower than those of any other living reptile. In fact, the rate of metabolism, as measured by the respiratory exchange of oxygen and carbon dioxide, was found by R. D. Milligan to be the lowest known for any vertebrate animal.

The low rate of life processes is probably associated with the low temperatures at which the Tuatara is active. The studies of Raymond D. Cowles, of the Department of Zoology at the

Since its arrival on November 3, the Tuatara has occupied an air-conditioned compartment in the lobby of the Reptile House where the temperature is kept between 55 and 70 degrees. It is feeding regularly.

University of California in Los Angeles, and Charles M. Bogert, Chairman of the Department of Amphibians and Reptiles of the American Museum of Natural History, have shown that our modern reptiles when active maintain the body temperature usually between 80 and 105 degrees Fahrenheit, depending upon the species. Mr. Bogert has kindly advised me that his studies indicate that *Sphenodon* maintains a much lower body temperature when active than any other reptile. This is a surprising aspect of this strange reptile, but is a fact that is interesting to consider in relation to the Mesozoic reptiles, as well as the slow pace of life in the Tuatara.

Another way in which *Sphenodon* reveals its slow rate of living is in the time required for the incubation of its eggs. Between November and January, in the early summer of the Southern

Hemisphere, the female deposits up to 14 hard-shelled, white eggs in the sand of an abandoned petrel burrow. These eggs are slightly more than one inch in length. They undergo fairly rapid development during the summer, but later the development is slowed markedly and hatching does not take place until twelve or thirteen months after laying.

The Tuatara has been heralded as a "three-eyed" reptile. A few early accounts attributed a high degree of function to the third eye. Actually *Sphenodon*, like a number of lizards, possesses a small sensory structure on the top center of the head, behind the eyes. This is called the pineal eye. In young Tuataras it is a fairly prominent structure, but it degenerates with age and is scarcely visible in an adult. Tests indicate that the structure does not function as a visual sensory organ. While the structure is different in detail in the lizards, a number of species have a proportionately much larger pineal eye than the Tuatara.

The foregoing account presents briefly a few of the peculiarities of this unusual reptile. The attributes that set the Tuatara apart from other living reptiles constitutes much of the interest that this animal has for the biologist. Through careful study of these features we can learn something of the characteristics of the reptile life of the Mesozoic. Dr. George G. Simpson, Chairman of the Department of Geology and Paleontology of the American Museum of Natural History, in his book, "The Meaning of Evolution," remarks on the striking similarities between the skeleton of *Homoesaurus*, a fossil Beak-head from the Jurassic of Europe, and that of *Sphenodon*. The almost identical nature of these two suggests that this reptile line has undergone virtually no change in the last 135 million years. Thus Dr. Simpson refers to the Tuatara as one of the "immortal . . . Methuselahs" of the animal world, and states that it represents one of the most unusual cases of "evolutionary stagnation" known.

In general, anachronistic organisms manage to survive in isolation from their more advanced relatives. *Sphenodon* has apparently been isolated in New Zealand for millions of years. As a species it maintained itself quite well in seclusion there until the coming of Europeans to the



islands. The domestic animals that were brought in, along with the destruction of cover plants by fire, wrought havoc on this reptile and it has now been exterminated on the mainland of New Zealand. The last ones were reported from the mainland around the middle of the 19th Century. Colonies of the Tuatara remained on a number of small, offshore, rocky islets, principally in the Bay of Plenty and in Cook Strait. Fortunately the great zoological value and uniqueness of the Tuatara was recognized and steps were taken to protect the remaining colonies. Before the beginning of the present century the protective measures consisted primarily of campaigns against the feral cats that preyed on the reptiles and controlled collecting of both adults and eggs. In the first quarter of the pres-

reful examination under a microscope of this fossil *Homoeururus* would reveal (arrow) a tiny bar characteristic of rhyncephalians, which lizards lack.

(Photo from a specimen in the American Museum of Natural History)

The bar forming the lower border of the lateral temporal opening of the Tuatara's skull may be seen quite plainly (arrow) in this skeleton of a Tuatara.

(Photo from a specimen in the American Museum of Natural History)



ent century permits were granted for the collection of a few adults, but in the past twenty-five years the Government has strictly prohibited the taking of any specimens.

In 1935 Dr. R. A. Falla, Director of the Dominion Museum at Wellington, listed some 19 outlying islets on which the Tuatara was then known to be living. These are all small and the total area of all of them together is less than that of the state of Rhode Island. Under the protection of the Government the Tuatara has made a noticeable recovery on these islands and now appears to be on the increase. Mr. William H. Dawbin, of the Department of Zoology, Victoria University College, is now conducting a study on the habits and population dynamics of these reptiles under the auspices of the New Zealand

Department of Internal Affairs. Thus through the action of interested biologists and a sympathetic government, one of the really rare animal relics of the world has been saved from extermination. Mr. Dawbin's studies should yield much valuable information on the way of life of the sole survivor of this ancient order.

For students of biology, other than those of New Zealand, the Tuatara is about as well known from personal experience as are its Mesozoic ancestors. Virtually every textbook of zoology mentions it as a "living fossil," a queer critter that has somehow withstood the vicissitudes of time and human folly. In America, only the National Zoo has exhibited the Tuatara, although a handful of live specimens have been brought into the United States for the scientific

collections of a few universities and museums. This reptile was displayed alive in several European zoos around the turn of the century. Some of these appeared to do well in captivity, with a specimen in the Dublin Zoo attaining a known age of thirty-three years. From the records of the European zoos there was little doubt that the Tuatara could be kept successfully in captivity. The main difficulties involved in putting the animal on exhibition in America were involved in getting permission from the Government of New Zealand for the collection and exportation of a specimen, and then getting it safely transported to the zoo.

Through the efforts of a number of interested persons, including Mr. Karl P. Schmidt, Chief Curator of Zoology of the Chicago Natural History Museum, permission was obtained to get one specimen for each of three zoos in this country — the San Diego Zoo, the Brookfield Zoo in Chicago and the New York Zoological Park. This was to be a trial project and, if successful, might lead to a limited exportation of Tuataras to the large zoos of the world. To insure the success of this experiment, the Minister of Internal Affairs for New Zealand had Mr. Dawbin collect four adults and prepare notes for the zoos on the care of the Tuatara in captivity. The reptiles were kept at the Auckland Zoo to acclimate them to captivity and to carry them through the winter hibernation period of the Southern Hemisphere. Elaborate preparations were made to ship them to America by Pan American Airways and this company issued a three-page set of instructions for its traffic agents on the care of the shipment en route. Finally, the Director of the Auckland Zoo accompanied the specimens on their trip to America. The New Zealand Government was sending the three Tuataras as a gift to the people of the United States. A fourth specimen was brought along to be sent on to the London Zoo.

On November 3, 1952, our *Sphenodon* arrived, like so many incoming animal shipments, at the inconvenient hour of 4 A.M. Nevertheless it was eagerly awaited by the Curator of Reptiles who was ready to gather it up and rush it to the Reptile House. The specimen was packed in a long wooden box, appropriately labeled, "New Zealand's Living Fossil Live Tuatara." The label

attracted the attention of the plane's pilot and he had to have a brief description of the reptile before he would relinquish his charge.

A little after 5 A.M. the box was opened anxiously in the Reptile House. The large head with its fringes on the back turned slowly upward and the alert, dark brown eyes followed every movement carefully. At once the Tuatara changed from a colorless, two-dimensional textbook figure to a living reality. After the first thrill of seeing this live remnant of the Age of Reptiles, the specimen was picked up gently and closely examined to make sure that the Age of Reptiles had managed its contact with the Air Age without damage. The specimen appeared in excellent condition. It was found to weigh $17\frac{1}{4}$ ounces and to measure $19\frac{3}{4}$ inches overall. Our Tuatara appears to be a male, although some zoologists believe that the sex cannot be distinguished with certainty by external characters.

We had prepared a special cage unit for the Tuatara in which we could control the temperature and maintain it at a range in keeping with that of its natural environment, which is reported to vary within a yearly maxima range of 40° to 70° Fahrenheit. The reptile was placed in its cage and appeared to get adjusted to its new home quickly, although it refused all food for several days. It appeared to resent being handled, wiggling and croaking softly like a frog whenever it was picked up.

Since this first week, it seems to have become completely adjusted to captivity. Now when its cage door is opened it frequently comes over and climbs out onto the keeper's hands, where it remains quietly while its chin is stroked. This is not a common type of behavior in reptiles, particularly in one that is supposed to be as lethargic as the Tuatara. It now eats readily, taking strips of raw meat, raw fish, worms and insects from tweezers or even from the hand of the keeper. We have noted two very interesting points in the Tuatara's feeding. First, it chews its food for a very long time, chopping it into a fine pulp and working it into the mouth at a slow rate. As mentioned above, it has an excellent shearing apparatus in the arrangement of its teeth. Our individual believes in putting this chopper to work regularly. The second point of interest to

(Continued on Page 31)



(Photos on this page by Ben and Sid Ross, courtesy Parade Magazine)

Left. — Pigeons being released for a homing flight, while an airplane follows them. Below. — The flock returns to its home roost after observation flights.



How Do They Find Their Way Home?

By HAROLD B. HITCHCOCK

*Associate Professor of Biology,
Middlebury College*

HAVE YOU EVER seen a flock of pigeons released far from their loft, watched them fly about for a few minutes and then head off in the right direction? If you have, you must have asked yourself, "How do they do it?" If you had inquired of the person who released the birds he probably would have told you he had no idea how they did it; racing pigeon fanciers as a group are not particularly interested in why their birds home. If your curiosity had led you farther, say to consult the Encyclopaedia Britannica or some learned ornithologist, you would have had little better luck in getting your

question answered, for the way in which birds orient themselves on homing flights is still as much of a mystery as it ever has been. The best the expert can do with this question is to tell you about some of the theories that have been advanced to explain the phenomenon. He might add that during the past decade the question has received considerable attention by investigators in this country and abroad, especially in England and Germany.

Homing pigeons and wild birds whose homing behavior is being studied are always banded for positive identification. Since some wild birds

like gulls are wary of being retrapped following homing flights, they may be painted in distinctive color patterns to make them identifiable at a distance. In studying the performance of homing birds it is customary to note the distance to be flown, the time the bird is released, the direction in which it disappears and the time of its arrival at the nest or loft. Speed in miles per hour or miles per day in the case of longer flights can be figured from these data. Until a few years ago almost nothing was known of a bird's behavior from the time it was lost from sight after release until the time it reached home. Occasionally a homing bird was recovered at an intermediate point, giving a clue as to its route. Now the airplane is being used to follow birds on their homing flight, and some of the questions that had perplexed students of bird navigation have been answered.

The foremost American investigator is Dr. Donald R. Griffin of Cornell University. Dr. Griffin's first work on the homing problem was not with birds, but with bats, which, incidentally, he found to be good homers. Gulls and terns were the first birds with which he worked. Although the homing speeds of these birds are not great, they manage to home in a fairly successful manner. Four out of six herring gulls he shipped to Chicago, for example, returned some 872 miles to their nests off Cape Cod. Three of these birds averaged less than fifty miles a day, and the fastest one made but little better than a hundred miles a day, certainly no great distance for a gull. In few of the many homings did the speed of return suggest that the bird had flown directly home. What sort of route had it flown? Was the delay due to feeding and resting? Or was it due to searching for familiar landmarks? These questions bothered Dr. Griffin, and in an attempt to find the answer he and his associates followed three gulls by airplane. None was followed all the way back to its nesting area, but the trial had demonstrated that following homing birds by airplane was practical. Working with gannets a few years later he and Dr. Raymond J. Hock made the first detailed study of homing

birds from the air. Gannets, like gulls, proved to be slow homers. Aerial observation showed why: they do not make a "bee-line" home, but travel in what appears to be a grand spiral. The initial direction of flight from the release point for the different birds observed was quite random. As gannets are oceanic birds, unknown inland, it is certain that these birds when released 213 miles from their Gaspé nests were in totally unfamiliar territory at Caribou, Maine, a hundred miles from the nearest arm of the sea. Their homing, Griffin concluded, could be explained adequately on the basis of exploration for landmarks that would provide them with information essential for reaching their nesting area.

How about the homing pigeon? Speeds of 50 miles an hour in races of several hundred miles are not uncommon. Even with favoring winds such speeds leave little time for exploration, and the proportion of successful homers in races makes it improbable that orientation toward the loft is a matter of chance. Again it was Griffin

The author is just releasing a seagull used in one of Dr. Griffin's homing experiments. Of 5 birds released at Port Stanley, Ontario, three returned over a 540-mile course to Cape Cod.



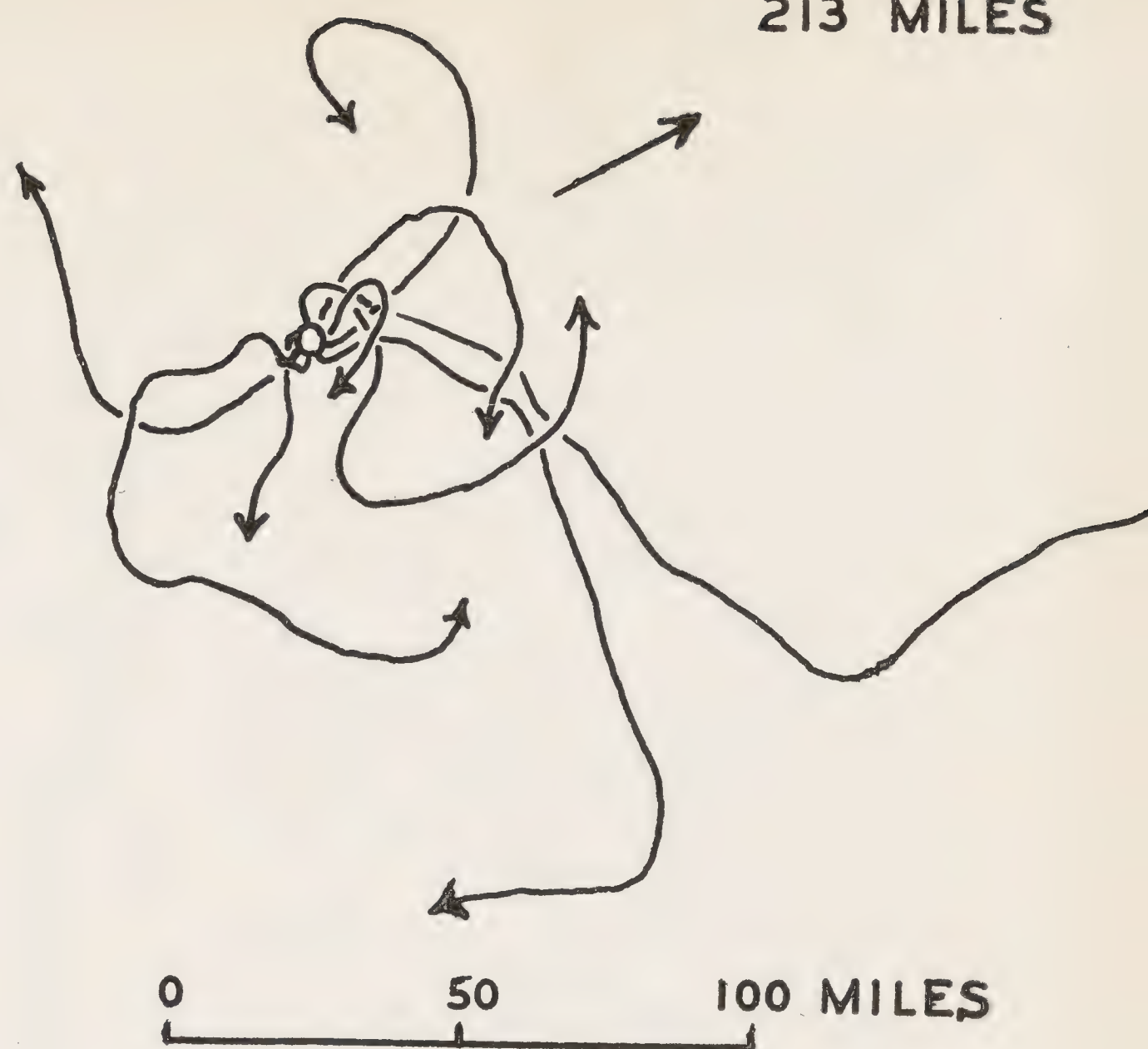
who pioneered in using the airplane in studying the homing of these birds. Although his observations were limited because of the size of his flock and a high loss rate on experimental flights, he was able to conclude that although the birds at times appear to rely on recognition of landmarks,

Gannets released in unfamiliar territory took these paths. Of 11 followed by plane, 7 homed. Flight paths of 9 are shown here.

(From Griffin)

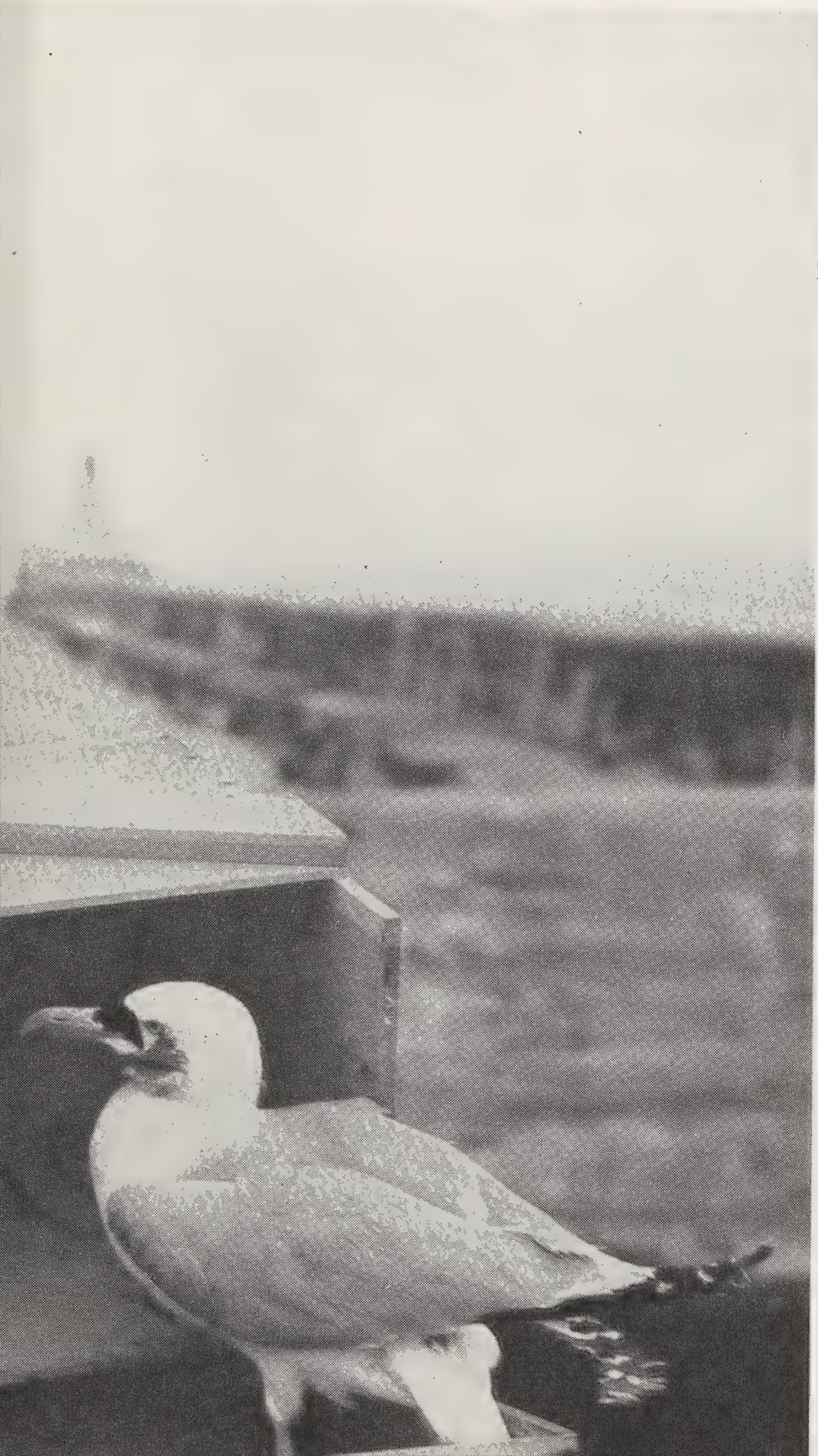
they are clearly able to select the proper direction of the loft without such cues. Grants from the American Philosophical Society and the able piloting of Mr. Robert Hunt, manager of the Middlebury Airport, have enabled me to make a somewhat more extensive aerial study of homing pigeons.

On homing flights the birds are carried to the release point in containers in such a way as to provide no visual clues as to the route they are taken over, whether by car, train, or plane. They



are released on the ground upon signal from the pilot when the plane is about 1,000 feet above them. The birds do not fly high — 1,000 feet is about as high as I have ever seen a flock — and usually they remain not much above the treetops. They give no indication of being influenced by the plane, and this is confirmed by the fact that flocks not followed “home” in times comparable to those that are followed. Over cities and near airports it is necessary to increase the distance between the plane and the birds, and this was found to be possible, no flocks being lost under such conditions. Once, while over suburbs of New York, a large air liner passed directly beneath us, between our plane and the birds. Luckily our encounters with other aircraft were infrequent.

Homing pigeons are of all varieties of color and pattern, and fortunately so, for in airplane following, dark birds become very inconspicuous against woodlands, and light colored birds show up poorly against such light backgrounds as fields of ripe oats or dry hay. Perhaps the most difficult background for pigeon following is that provided by towns and cities, where pattern changes are frequent and abrupt. Reflections of the sun from water are bothersome, but fortunately most of the flocks were followed where large bodies of water were infrequently encountered. Because the speed of pigeons is about 45 miles an hour, somewhat slower than that of the plane, constant circling is necessary. Occasionally the plane





Flight paths of homing pigeons released near the loft show good initial orientation but erratic courses. On longer flights they are much more direct. "Lost" means lost from sight.

had to be banked in such a way as to cut the birds off from sight momentarily. In such instances it was extremely difficult to relocate them, as they make a small and inconspicuous target. Once the birds eluded us by outclimbing the plane. The pilot has to exercise constant vigilance lest the birds put him in a position where he can not see them while manoeuvring his plane.

Strangely enough, pigeons released within a radius of 10-15 miles of the loft seem to be more puzzled than when released at a greater distance. Other investigators have noticed that within limits homing speeds increase as the distance to be flown is increased. One might expect that nearby territory would offer no problem in orientation as the birds would recognize landmarks and quickly get their bearings. Yet on several occasions when even the person on the ground who

released the birds could identify landmarks within a short distance of the loft they headed off as much as 30° from the proper direction, and persisted in that direction for several miles. Moreover on short flights the birds are more influenced by the topography beneath them than on longer flights, following a ridge, for example, rather than crossing it.

The flight paths of pigeons show little resemblance to those of gannets. After a few minutes of what might be called an orientation flight near the release point they begin the true homing flight. Usually, but by no means invariably, the initial direction of this flight is within a few degrees of the loft. Highways and railways, valleys and mountains, influence the course little if at all. I have watched my birds climb some of the higher Green Mountain and Adirondack elevations in their path rather than deviate from their course by a few degrees to take advantage of lower ground. One flock that was maintaining a very straight course from Burlington to Middlebury flew right over the top of Mt. Philo, a conspicuous little peak that stands off by itself in the

gently rolling meadows and pastures of the Champlain Valley. A few hundred feet to one side or the other would have saved them the climb. Large open spaces are avoided if wooded areas are close by. This behavior seems to be associated with the need for cover in case of hawk attack. Hawks are rather numerous in Vermont, and few of the longer flights were finished without at least one attack.

The flock, when set upon by a hawk, breaks up with explosive suddenness. Some of the pigeons drop into the trees; others fly off in various directions; some climb high. The hawk, after one or two dives, leaves the birds, and the ones still flying regather. Often they will fly very rapidly for a few minutes, then perch. Only once was I sure that a pigeon had been caught by a hawk. In this case the victim was the runt of the flock, one that had been raised by hand after its parents had abandoned it. Hawks, I believe, rarely catch a healthy pigeon, even after it has flown many miles, but their attacks do scatter the birds, making it necessary for some of them to complete the trip alone rather than with the flock.

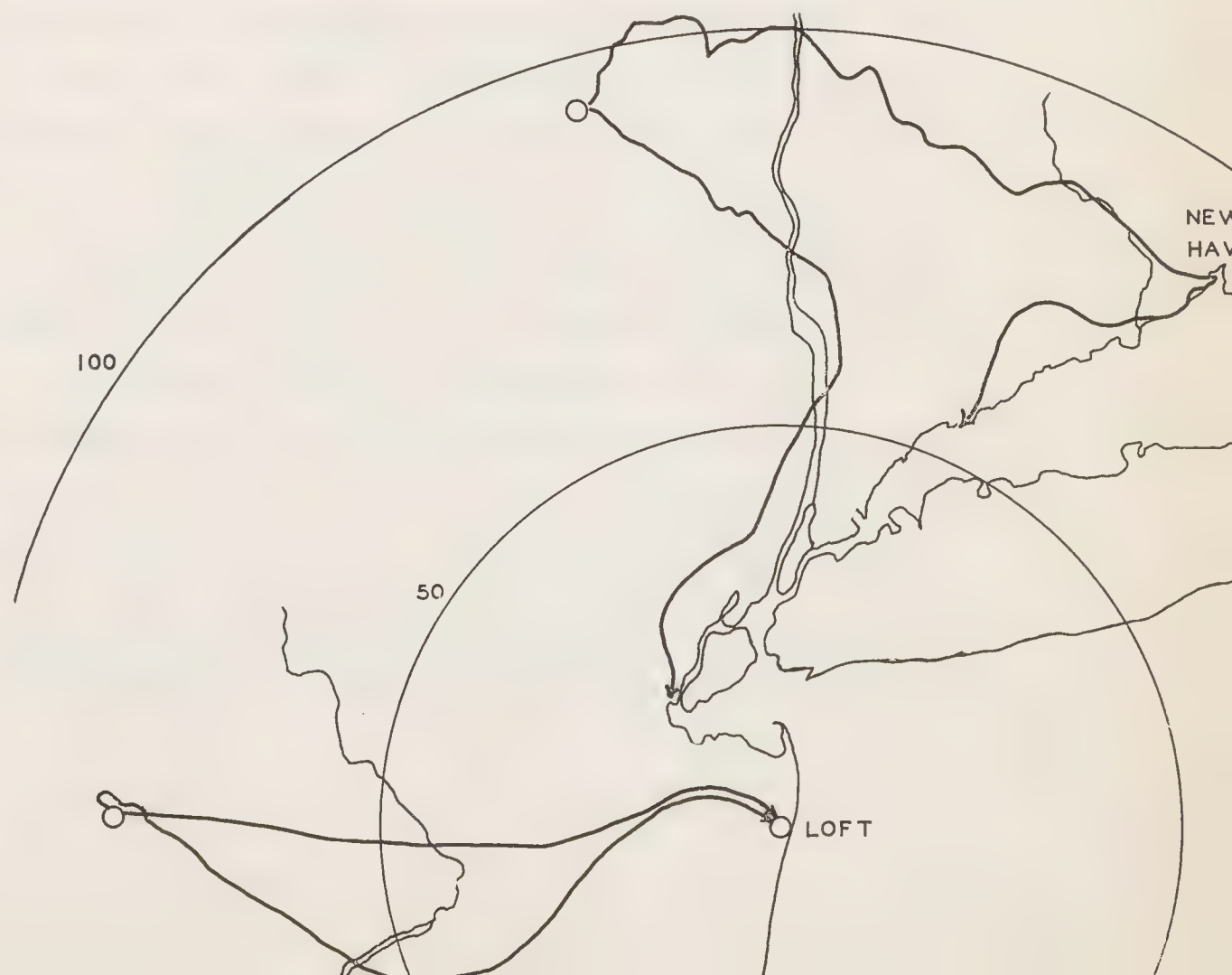
Racing pigeon fanciers usually train their birds only over the line along which they are to be raced. Thus pigeons that may have flown in 1,000 mile races may never have been released in any but the direction of the races. Such training, racing men believe, is conducive to faster homing and fewer losses than when the birds are trained in various directions around the loft. I was fortunate in being able to follow flocks from a large loft in northern New Jersey that had received all their training from the west. Two such flocks of young birds were followed from a release point 85 miles to the west, and 15 miles from the nearest point at which they had been released previously. Both homed beautifully, the routes being fairly direct and all birds remaining together throughout the flight. But when birds from the same loft, with the same training, were released 90 miles north of the loft, in the Catskills, the results were different. The first flock headed

southeasterly upon release, crossing the Hudson before orienting toward the loft. The second, whose performance was observed from the plane with me by the man who had supervised their training, also flew a southeasterly course. After one hour and twenty minutes there were indications that some of the birds suspected they were on the wrong course, but no desertions occurred for another hour. The birds we followed kept on doggedly to the east until they reached New Haven, Connecticut, and the sea. There they made the right decision and headed back toward the loft. Of 20 birds released only 7 homed the same day. Seven others returned later; the rest were lost.

Though their behavior confirmed the belief of the racing fanciers in the advantages of training birds only in the direction in which they are to race, the results came, I am sure, as a shock to my friend, for judged by breeding and performance up to that time they were good birds. Later in the summer another trial was made. By this time some of these youngsters had flown from as great a distance as 250 miles. Ballston Spa, New York, 200 miles north of the loft, was chosen as the release point, and 23 birds were liberated there in one flock. Their behavior from the outset indicated confusion, as they flew first north, then south, most of them finally agreeing on an easterly course. The birds were lost from view over the Hoosac Mountain range, a few miles from North Adams, in western Massachusetts. Of these 23 birds only 4 homed; nothing was heard further from the others.

Such behavior was most disturbing. Racing pigeon fanciers know (better than the average citizen, who believes them to be absolutely dependable) that pigeons make mistakes. But mis-

On this diagram, the two flights from the west were in the direction pigeons had been trained to fly. Note tendency of the birds to persist in flying that direction when taken north.



takes on the scale just described are not common; pigeon racing would be too expensive to be a popular sport if they were. Perhaps older birds would not make such bad errors. Fortunately my friend had one- and two-year old birds he was willing to try on a second series of trials. All of them had been trained to at least the 100-mile mark on the west course, and several had flown from greater distances. The same release points were used as before, but this time the birds were released singly rather than in flocks. To encourage finders of strays to report birds that might fail to home, message capsules in addition to the bands were placed on each bird with instructions to report when and where the bird had been found.

Of the 9 birds released 90 miles north of the loft only 2 took a course that suggested they were properly oriented toward the loft. One of these was the only bird that homed. The others flew in easterly and northerly directions. Because of the necessity of observing budgetary limits no bird was followed more than one hour in this series. The only stray bird reported had flown almost to Hartford, Connecticut, in the direction of its training.

Ten birds were released at the 200-mile point, Ballston Spa. They showed even more clearly the effects of directional training. Their flight paths were predominantly to the east, and not one homed. Of the four strays reported, one had flown north to Oneida, New York; one had flown easterly to southern Vermont; two were picked up at different places within a few miles of Boston, Massachusetts. For several weeks I wondered whether I might not still hear from some of the others. Might not they have kept on flying when they reached the sea? But so far no message from sea captain or fisherman reporting a sea-going homing pigeon has been received.

The conclusion is clear: homing pigeons, old as well as young, can be taught to fly in a particular compass direction. But direction flying is not always homing, as the above instances so clearly show. Possibly the ability to learn a compass direction will be a useful clue in solving the problem of homing.

One might get the impression that pigeons are really very poor homers. Apparently whether they are good homers or bad depends largely upon the

training to which they have been subjected. Recently, Dr. Gustav Kramer of the Max Planck Institute at Wilhelmshaven, Germany, has reported that several flocks of his birds with limited training homed from a distance of 200 miles almost without loss and so swiftly that even he was unprepared to receive them upon their arrival. The most remarkable part, however, is that the birds were apparently oriented before their release. Eight small flocks were released singly at well separated intervals from the top of a medieval tower. There was no circling, and the birds used their altitude to gain speed as they swung around into the direction in which they immediately disappeared from view. In every instance the direction was very close to that of the loft. These better than any other observations of homing pigeons demonstrate the reality of a keen ability to orient toward the loft. It does not seem unlikely that the poor performance of the directionally-trained birds reported above is the result of their training — training that has dulled their inherent ability of orientation.

Most of the theories proposed to account for homing are based on the detection of stimuli to which man is insensitive, such as magnetic and electrical forces, radiations of various sorts, from ultra violet to cosmic radiation, and the force of the earth's rotation. So far experimentation has failed to demonstrate that birds themselves are sensitive to these forces. One clue, however, has been uncovered: birds home poorly when there is a complete heavy overcast. The sun itself need not be visible, but its position must be ascertainable if orientation is to be achieved accurately. The fact that many birds are nocturnal migrants and that pigeons can be trained to home at night suggests that knowledge of the sun's position may not be the only way in which orientation can be achieved.

So the question "How do they do it?" remains unanswered.

As man extends his understanding of the forces about him the challenge to find the answer becomes greater. It would be rash to predict when the answer will be found, but I venture to express the belief that man will never cease to marvel at the homing performance of birds, regardless of whether or not he understands how the orientation is achieved.



**Dominated by a crystal column
and a stairway to other halls:
The Temperate Freshwater Hall.**

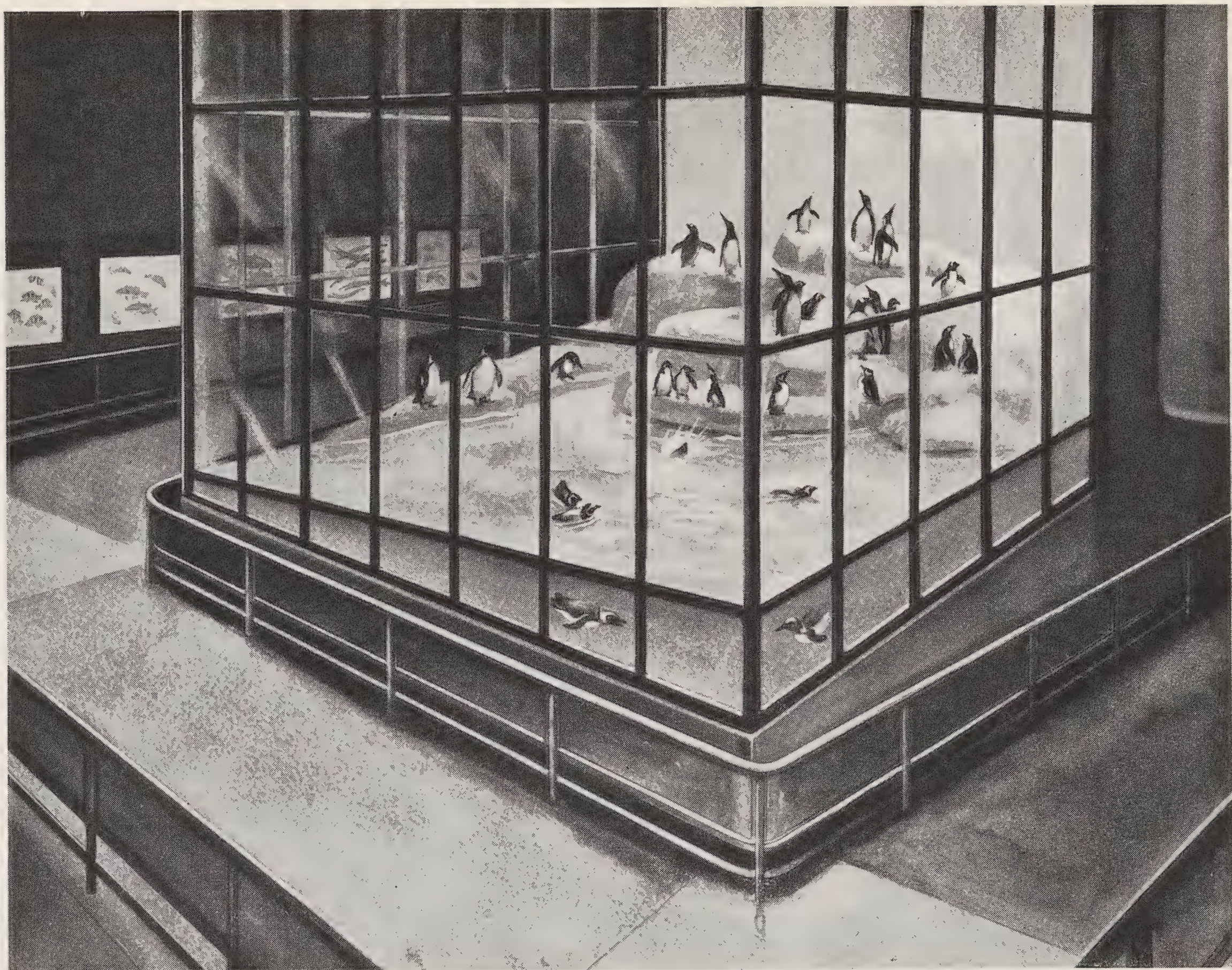
(Drawing by Carl Burger)

New York MUST Have A New Aquarium

By DONALD T. CARLISLE

OUR NEW YORK of 1953 is so richly endowed with museums, libraries, zoos, botanical gardens, parks, beaches and other facilities for public instruction and recreation that it is hard to imagine a time when these did not exist. Yet there was such a day, and not so very long ago. Our own Zoological Park is but fifty-three years old, and those vast institutions, the American Museum of Natural History and the Metropolitan Museum of Art, antedate us by only a relatively few years.

The New York Zoological Society, formed in 1895 for the purpose (among other things) of giving New York a worthy zoological garden, came into being in the Golden Age of public benefaction. This was the era when small groups



The Antarctic Penguin exhibit will be a glass cube 30 feet in each dimension, refrigerated and supplied with filtered air. A spiral ramp gives a view of the birds above and below water.

(Drawing by Carl Burger)

of public-spirited citizens banded together in non-profit, non-partisan societies to petition the City for the right to create and administer this or that institution for the public good. It was also a day when the building dollar went much further than now.

Essentially the genesis of all the major public institutions of the Greater New York area was the same, with one important exception. In the days when the Zoological Society was little more than an idea struggling for acceptance by the City Fathers and the New York State Legislature, the people in City Hall were contending with another problem. Down on the waterfront at the Battery there stood an ancient structure which had served the nation and the city in a number of ways — as a fort, a music hall, and

then as the port of immigration. By 1895 the old building had outlived this latter function and again the question arose of what to do next with old Castle Garden.

We can only surmise the relief with which the City Fathers accepted some unrecorded hero's suggestion that Castle Garden be turned into an Aquarium. An Aquarium it became, and a great one. But an Aquarium is a most intricate aggregation of tanks, pipes, valves, water and livestock, and not for the uninitiated to administer, so it was no time at all before the municipal land-lubbers were in hot water, cold water, salt and fresh, and in 1902, less than three years after the Zoological Society had opened the new Zoological Park, the City authorities asked the Society to undertake the Aquarium's operation.

Your Society managed the old institution at the Battery until it was closed by tunnel construction in 1941, and during those thirty-nine years the New York Aquarium became one of the truly great aquariums of the world, noted not

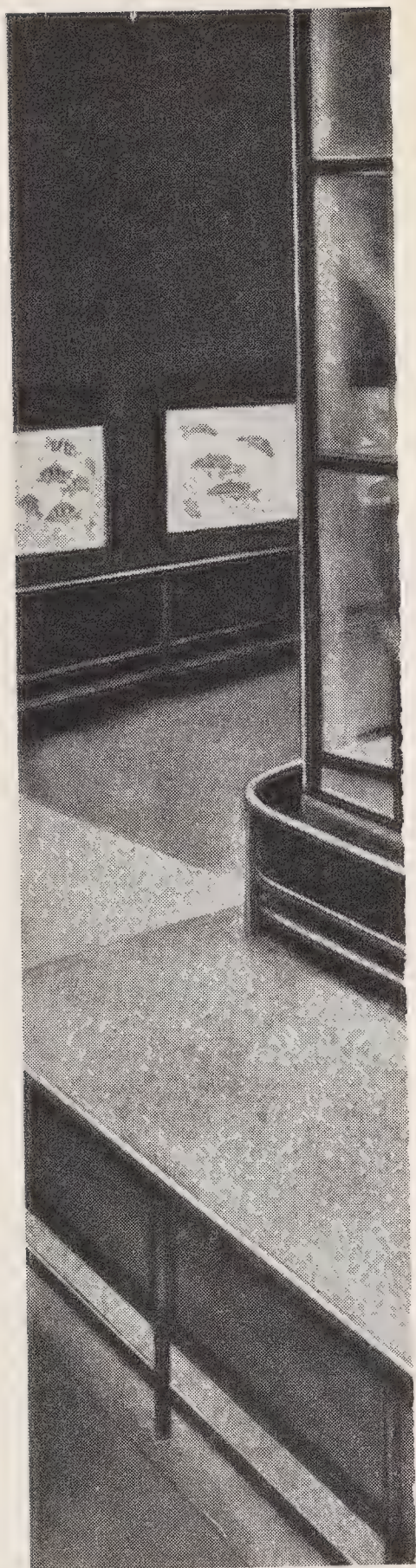


THIS IS

A "Cut-Away"

KEY

- 1—Main Entrance
- 2—Library . . .
- 3—Entrance Way
- 4—Clouds-to-Ea
- 5—Three Banks
- 6—Coral Reef
- 7—Shark Tank
- 8—Ten Research
- 9—Two Banks
- 10—Eight Large
- 11—Oceanic Tan
- 12—Electric Eel
- 13—Fifty Tropic
- 14—Four Large
- 15—Swamp Cori
- 16—Four Tempe
- 17—Eighteen Te
- 18—Four Trout
- 19—Crystal Col
- 20—Sixteen Sm
- 21—Seven Large
- 22—Twenty-fou
- 23—Antarctic P
- 24—Temperate
- 25—Oceanic Ta
- 26—Auditorium
- 27—Gardens .



**The Antarctic Penguin
cube 30 feet in each
supplied with filtered
a view of the birds**

(Drawing by Carl Burger)

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THIS IS THE WAY IT WILL BE

A "Cut-Away" Drawing of the New Aquarium

KEY	COST
1—Main Entrance and Colonnade.....	\$250,000
2—Library	55,000
3—Entrance Waterfall	25,000
4—Clouds-to-Earth	125,000
5—Three Banks of Tropical Marine Tanks.....	200,000
6—Coral Reef and Moray Tanks.....	175,000
7—Shark Tank	250,000
8—Ten Research Laboratories.....	125,000
9—Two Banks of Marine Tanks.....	150,000
10—Eight Large Marine Tanks.....	600,000
11—Oceanic Tank	200,000
12—Electric Eel Exhibit.....	50,000
13—Fifty Tropical Freshwater Tanks.....	200,000
14—Four Large Tanks (Crocodiles, etc.).....	150,000
15—Swamp Corridor	100,000
16—Four Temperate Freshwater Tanks.....	40,000
17—Eighteen Temperate Freshwater Tanks.....	270,000
18—Four Trout Tanks.....	60,000
19—Crystal Column	25,000
20—Sixteen Small Freshwater Tanks.....	80,000
21—Seven Large Freshwater Tanks.....	52,500
22—Twenty-four Temperate Marine Tanks.....	180,000
23—Antarctic Penguin Exhibit.....	250,000
24—Temperate Zone Penguin Exhibit.....	75,000
25—Oceanic Tank	200,000
26—Auditorium	62,500
27—Gardens	50,000

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only for its collections but for the integrity of its scientific accomplishments. Naturally, you wouldn't pick out an ex-fortress as an ideal Aquarium foundation, and history provides many an example of the insufficiency of the building for this purpose. Nevertheless, the old New York Aquarium was host to an average of more than 2,000,000 visitors a year, challenger of our own zoo for popularity leadership, and its staff made many a contribution to scientific knowledge in broad fields of research.

IT IS BECAUSE of New York's great abundance of facilities for public instruction and recreation that it is difficult at first to realize that there are any voids. Yet the old Aquarium at the Battery has been gone a dozen years. All that is left of it is some forty small token tanks in the Lion House at the Zoo.

Now history has performed its well-known trick of repetition, and the Zoological Society is again challenged. In 1895 the "dare" was to build a great zoological garden for New York. Now we are accepting the challenge, or more properly the unique opportunity, of giving back to New York the one great institution lacking in our modern metropolis — the Aquarium.

This challenge has not been lightly accepted. Plans for the new enterprise have been many years in the making. Blueprints by the hundred, plotting the new Aquarium down to the very last valve, have been completed. Surveys of the area in which it will be situated have been conducted

A corner of the great Oceanic Hall, showing the overhead passageway. In this hall will be exhibited the larger marine fish — groupers, dogsnappers and the like — except the sharks.

(Drawing by Carl Burger)



with a view to measuring its probable annual attendance. The land on which it will stand has been made available by the City, and the City has indicated its readiness to supply half the basic construction and conditioning costs.

Building and equipping the new Aquarium for New York will require somewhere between nine and ten million dollars, according to the best measurements we can make of current costs. Of this total the Society has accepted a goal of \$5,000,000. This is the largest sum of money your Society has ever sought to raise for any purpose. It is almost as large as our total endowment built up over half a century. It is twenty times as big as the \$250,000 with which we started the Zoological Park.

There is another fact with which we have stubbornly struggled in the decade of Aquarium planning: when you build an Aquarium you are building a complete entity, and all your construction money must be in hand at the outset, for an Aquarium cannot be built piecemeal. Our Zoological Park was opened in 1899 but the complete plan of construction was not realized until 1912. When the new Aquarium is opened it must be opened all at once, working perfectly in all particulars. There will be no opportunity for afterthoughts. So the gauntlet is thrown to your Society again. The challenge is a greater one in many ways, but never has the Society had a better opportunity to serve our community.

Some years ago a benevolent gentlemen, wishing to leave his wealth invested as wisely as possible for the public good, caused a survey to be made of the recreational-educational facilities of his community. The recommendation of the survey was that the city in question needed an exhibition of aquatic life, an aquarium, more than anything else. Thus the great Shedd Aquarium in Chicago came into existence. In Boston the terms of the White Fund, long kept secret, were recently revealed, and one of the major purposes of its creation was an Aquarium for Boston.

WE HAVE EVERY REASON to believe that somewhere there is a man or woman, or two or three such, who will see in this great project of ours the perfect opportunity to serve the community and the world of science, by pledging the lion's share of the Society's commitment — say

\$3,000,000. With the City of New York bearing the land costs and half the costs of construction, a donor can perpetuate his name or the name of his choice with a gift of a relatively small part of the total investment.

Again, while there may not be so many candidates for the honor of helping the Society by giving the greater share of our commitment, there is undoubtedly a rather large number of people who could give a hall or a tank in the name of themselves or that of a relative or friend. One of the illustrations of this article shows the manner in which the new Aquarium breaks itself up into opportunities for unit gifts.

Beyond the interest of our members and friends, we of the Society staff have investigated the public feeling about the new Aquarium plan. There can be no question about the public's desire for the restoration of the Aquarium, nor about its enthusiasm for the plan as it has been presented. It is fair to say that the school authorities of the city, from Superintendent Jansen down, look to the new Aquarium as one of our most needed educational resources.

Considering the popular feeling for the enterprise it is possible, all else failing, that we could finance the undertaking largely from rather small public contributions. The Boston Museum of Science recently built a planetarium by means of a campaign urging people to "buy a star."

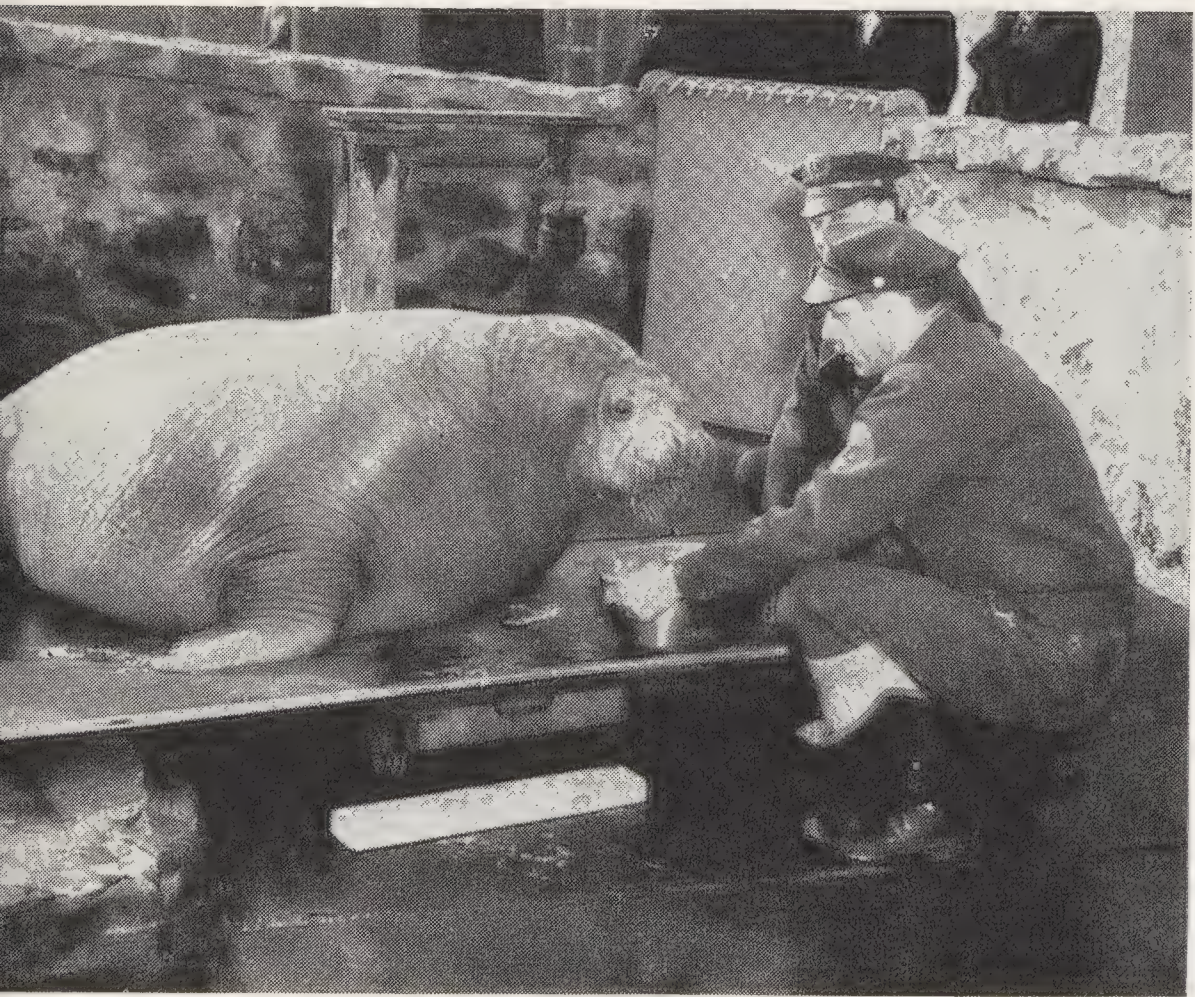
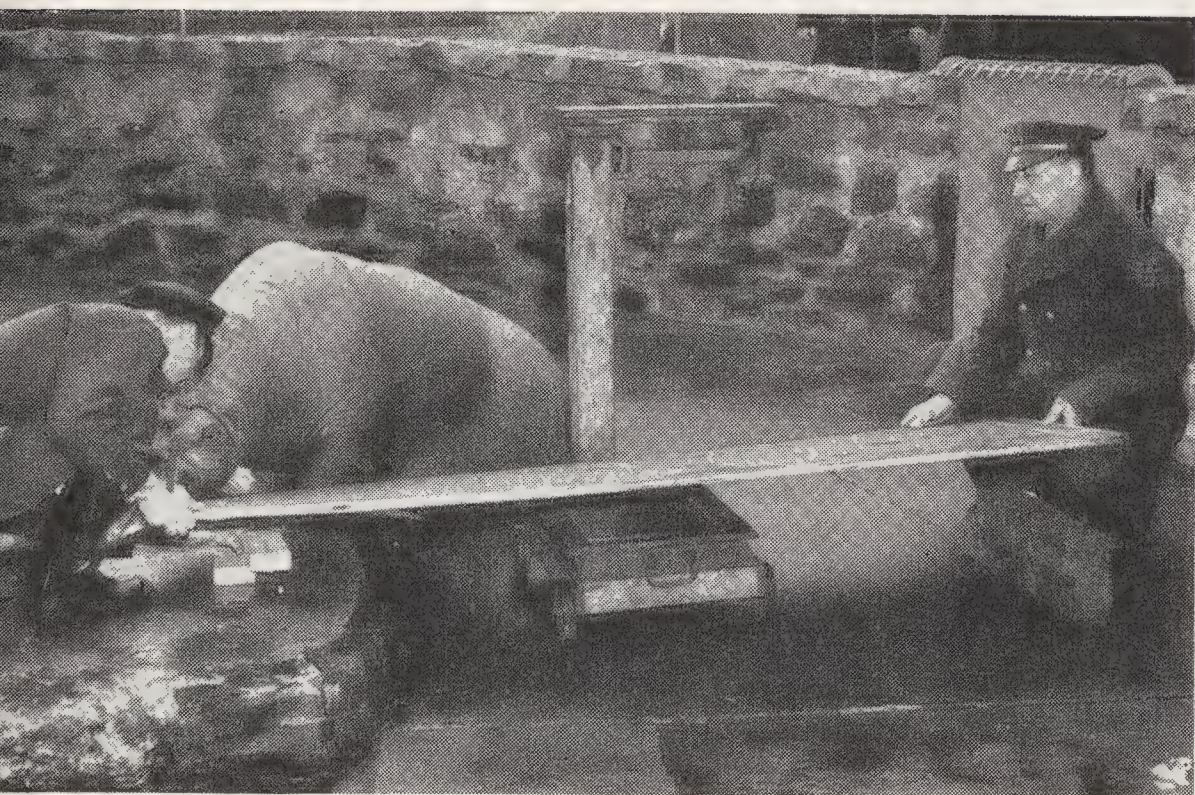
We believe — in fact, we know — that any widespread popular campaign is an expensive money-raising method, and we hope rather that our effort will be a short one and conclusive. After all, New York needs the Aquarium, New York wants the Aquarium. We permit ourselves to be hopeful that the magnificent new plans for the Aquarium, the unique character of this opportunity for public service, will have so much appeal that we can lay the physical foundations soon — perhaps, with luck, this very winter.

* * *

Every Society member, it is hoped, will realize a responsibility to the Aquarium project. In the course of time we may call on you each for some specific form of help. In the meantime, if you know of anyone who might have a major interest in this enterprise, will you please send us his name, with the reasons why you think he might be persuaded to help substantially?

The Weighing of Herbert

By WILLIAM BRIDGES



THREE QUESTIONS pretty nearly everybody asks about the larger and more spectacular mammals are: "How old is he?" "What does he eat?" and "How much does he weigh?" From the very first we have been able to answer the first two questions promptly and definitely as they apply to Herbert, our juvenile Walrus. Up to a certain point we could even answer the third question. But now it is getting increasingly difficult to say what Herbert weighs, and something is going to have to be done.

It isn't that Herbert isn't cooperative when we roll out the portable scale and prepare to assess his *avoirdu pois*; he is. That's part of the trouble. He adores his keeper, his keeper's helper, the scale, the pan of fish used to entice him onto the platform, the visitors who crowd around — he adores everybody and everything. His affection, and curiosity, take the form of crowding up against the keeper and his helper and trying to lay a trusting muzzle on their knees or in their laps. If he has just previously sneaked a mouthful of chopped fish and codliver oil, his muzzle

Four stages in the weighing of Herbert are revealed in this series of pictures, although actually there is an infinite series — the times when Herbert is half on and half off the scales, and undecided what to do next.



is apt to be moist — to say the least. And if the keepers and the fish elude him, there remains the alternative of nuzzling the scale to throw it off balance, or trying to look under the platform, or as a last resort of simply flopping over on his side and looking helpless.

Visitors always laugh when that happens, and that is Herbert's cue to roll upright and struggle over to the wall to see what the nice people are laughing at.

Despite all these handicaps, we *have* managed to maintain a fairly regular schedule of weighings. On January 6 of this year Herbert was complaisant enough to climb on the platform of the scale and to stay there for several minutes at a time, so that an accurate reading could be obtained. He weighed 770 pounds.

For a baby slightly under two years of age, that is not bad. Certainly it is the best record we have ever made in bringing along a baby Walrus and it exceeds even the best record of the Copenhagen Zoo, the acknowledged Walrus headquarters of Europe.

Before heaping too many laurels on our own head, however, we must add that "Tove," the Copenhagen Zoo Walrus whose remarkable growth rate has recently been published, is a female. Our Herbert is a male, and male Walruses are much larger than females, so a more vigorous rate of growth is to be expected.

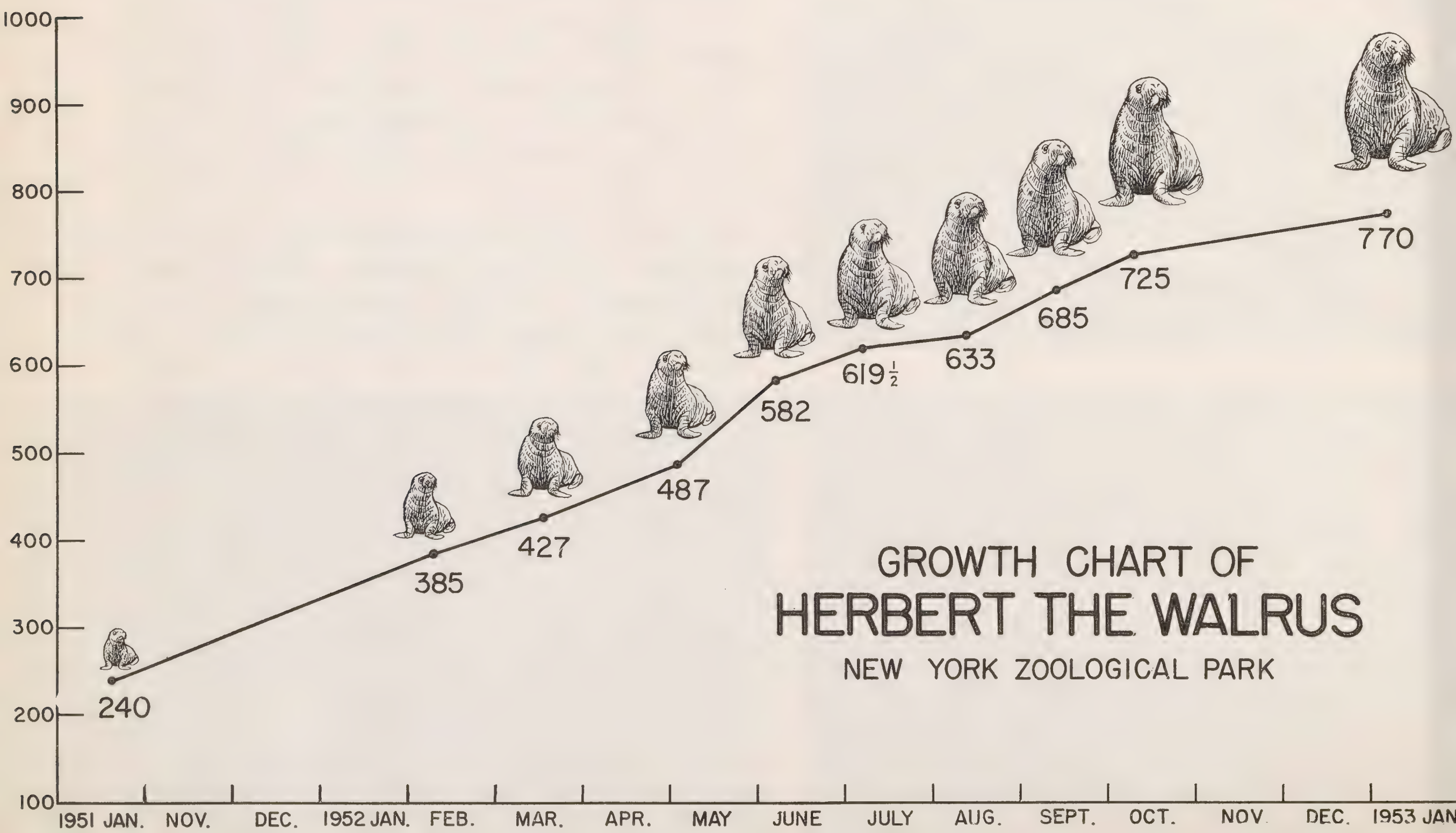
Also, that the diet and feeding technique for

baby Walruses was worked out by Mr. Alex Reventlow, Director of the Copenhagen Zoo, and that it is his system we have been following in our care of Herbert. Some modifications are our own, dictated by conditions on this side of the Atlantic, but the basic program for "The Care and Feeding of Baby Walruses" is Mr. Reventlow's. All Zoos — and all Walruses in captivity — will perpetually owe him thanks, for it has been a long and rocky road from ignorance up to our present knowledge of how to keep this appealing animal in zoological gardens.

Our own experiences with Walruses are probably typical, with the exception that the eight specimens we have exhibited since 1902 are somewhat more than most American zoological gardens have possessed.

Our first Atlantic Walrus came on September 21, 1902, as a gift of the Peary Arctic Club. The Accession Record of those early years — the Zoological Park at that time was less than three years old and our first Walrus was Mammal No. 1283 — reveals provokingly little. The Walrus was part of a composite gift that included a Musk-ox and four Eskimo dogs; pencilled alongside the entry are the words "Died a few weeks later of enteritis." Of its weight, feeding schedule and behavior we know nothing.

Our No. 2 Walrus was the famous "Flip" whose longevity of almost four years made us think we knew at least a little about Walruses.



Flip was a gift of the late Paul J. Rainey and came on September 17, 1910, at which time he weighed 147 pounds. The Mammal Department was determined to make a success of this Walrus, and brought all available knowledge and skill to its care. Clams are known to be a favorite food of the Walrus in the wild, and Flip was started off with nine pounds of clams a day — net weight, without the shells. Eventually this was worked up to 28 pounds of clams a day, all of them opened by hand. Clams and fish alternated on the menu, and even the fish were a hand operation, for the bones were meticulously removed. In a note on "Care of the Walrus" in our *Bulletin* for September, 1911, the late Dr. Raymond L. Ditmars mentioned that "It takes over two hours each day to prepare this animal's food, and to this must be added the daily scrubbing of the rocks surrounding his pool, and the regulation of the salt water in the same."

Flip's diet was carefully coordinated with appetite and increase of weight, and the latter was recorded at two-week intervals. In the succeeding four years there were occasional waverings in Flip's weight chart, including one alarming loss of 33 pounds in fourteen days, but the general trend was slowly upward, and when Flip succumbed on July 5, 1914, he had, in the previous February, attained his maximum of 415 pounds.

At the time, we thought that was a wonderful rate of development — and so it was, by the Walrus standards of the day.

Later experiences with Walruses must be passed over quickly, for they make melancholy reading. Between 1935 and 1940, five young Walruses came into our collection, all of them through the efforts of Capt. "Bob" Bartlett, and all succumbed within a few weeks or months, despite our efforts to apply the formula that had been so successful in the case of Flip.

Looking back, we know that they were doomed. Early care is all important — a vigorous shove forward with plenty of fat content in the food. These five babies were unable to get that important care during the weeks between their capture in the Arctic seas and their delivery to the Zoological Park, and all our stuffing was unable to arrest their decline.

With Herbert, our No. 8 Walrus, it was dif-

ferent. In recent years Mr. Reventlow's application of the principle that heavy dosing with cod-liver oil is vitally important had come to be known in Europe, and when a Danish animal dealer obtained Herbert and several other young Walruses soon after their birth in the spring of 1951, they were "started off" with exactly the kind of fattening diet they required. During the summer of 1951 General Curator Emeritus Lee S. Crandall discussed the Walrus problem with Mr. Reventlow and stored up the information we were to need when Herbert arrived some weeks later.

The graph accompanying this article gives the statistics of Herbert's steady upward development. It need only be added that, starting with 10 pounds of chopped fish, evaporated milk, cod-liver oil and vegetable oil per day when he arrived, the menu has been steadily increased in bulk until now he is getting 40 pounds of chopped fish every day, with 1200 cc. of evaporated milk, 700 cc. of vegetable oil and 100 cc. of codliver oil poured over it. The sloppy mixture is offered in two equal portions, morning and afternoon, and Herbert cleans it all up. As he grows, this allowance will be systematically increased, two or three pounds at a time.

"Tove," the Copenhagen Zoo's female Walrus, increased from 99 pounds to 770 pounds in two years, four months and seven days; Herbert has jumped from 240 pounds to the same figure of 770 pounds in one year, two months and nineteen days, just a trifle more than half the time. He started larger, and he is a male. Nevertheless, we are proud of his response to our ministrations and look forward to the day when he approaches the apparent maximum for his species of around 3,000 pounds.

At the beginning of this article we said that something is going to have to be done about getting routine weight records of Herbert. The problem is that our portable scale weighs up to a mere 1,000 pounds. By late spring Herbert will surely be too big for his scale. His willingness to climb aboard and be weighed we don't for a minute doubt, but we are going to have to get a bigger set of scales or, better still, build in a permanent platform scale, such as we use for weighing trucks. For if Herbert isn't yet quite as big as a truck, he's on his way.



The Black Bear Still Hangs On

By WILLIAM J. HAMILTON, JR.

Professor of Zoology, Cornell University

A CENTURY OR MORE AGO, practical values placed the Black Bear with other prime favorites among the early settlers. His hide and deep mat of fur were used for clothing and bedding. Old World guards, patrolling the gates of royalty, were capped in bearskin helmets. More important, the mythical value of the fat, rendered into bear oil, had a multiplicity of uses, and was revered as a panacea for many ills. The fat, once reduced to oil, was used for cooking. John Bartram recalls a Florida Black Bear that yielded more than a dozen gallons of clear oil and found it "incomparably milder than hogs-lard and near as sweet as oil of olives." Presently the bear is a trophy alone, its black bulk hung on a limb, to be photographed with the intrepid hunter who dares cross its path. To be sure, there are those who make bear hunting a hobby and a business, a few who wish to know this fine creature in its natural haunts. A small legion of hunters pursue Bruin each year, travelling from one state to another when the season appears favorable. These bear hunters know the animal well; they have spent years following the trails. Biologists are indebted to such men for the lore of scientific facts regarding this fine animal.

According to legend, the size attained by the Black Bear approximates half a ton. A year ago an upstate New York paper contained a picture of a large Black Bear, the caption indicating that the monster weighed 800 pounds. To be sure, there are big bears, and surprisingly enough the heaviest appear to live in the Florida swamplands. Bona fide records include a Pennsylvania animal that weighed 633 pounds, a Yosemite specimen of 680 pounds and a Louisiana behemoth of 671 pounds. M. E. Musgrave, hunter for the Fish and Wildlife Service, killed a large Black Bear in the Navajo Mountains of Arizona that reputedly weighed 900 pounds. These must indeed have been formidable creatures. It is easy to over-estimate weight, particularly when viewing the hulk of a slain bear. Large scales, hunters and bear are not often in intimate relation. Not long ago a nursing bear was viewed by a number of hunters who had plenty of experience with the beast. Estimates of the weight ran to 300 pounds. The undressed creature actually weighed 136 pounds, a sixth of this comprising a saddle of fat over the back.

Unlike the grizzly, with its concave snout and humped shoulders, the smaller Black Bear sports

a straight facial profile and a bulk dwindling away from the head. Its strength lies in the massive forearms and great tusks, which seldom need be brought to play against its diminutive prey. And too, unlike the grizzly or the great brown bears of Alaska, the Black-robed creature has short, sharp claws, well adapted for climbing.

While its sable coat serves to distinguish the Black Bear from others of its kin, western individuals are often brown (the so-called Cinnamon Bear). Both black and brown cubs may occur in the same litter. Surprisingly, this brown phase appears to be restricted to western America. One of a litter of three Catskill cubs had a gray coat. The Glacier Bear of southeastern Alaska, whose bluish-black coat is frosted or silver-tipped, is merely a rare color phase of the species under consideration.

Few large mammals are so widely distributed over North America, and few so seldom seen, as the Black Bear. Its secretive habits and stealthy movements have spared the bear, so that today it still occupies a great part of its original range throughout the forested regions. Occurring from Labrador to Florida and Alaska to the tablelands of Mexico, the Black Bear still maintains its numbers. Indeed, in parts of the east, Bruin appears to be occupying areas from which it was notably absent for many years. This may be due to the abandonment of marginal farm lands where reforestation has once more provided a suitable haven for the big fellow.

Early settlers have faithfully recorded the abundance of the Black Bear in the eastern forests. A century ago, an Adirondack hunter is reputed to have killed 96 bears in three seasons,



Self-portrait of a Black Bear. This is the flashlight picture mentioned by the author, taken on Mt. Katahdin in Maine many years ago by Dr. Francis Harper.

while Bill Long, a famous Pennsylvania woodsman, is credited with slaying 400 bears in his lifetime, seven of which were killed in a single day. There is plentiful testimony from the records of the older naturalists of its once great abundance.

Warfare against the Black Bear was necessitated in pioneer days by its destruction of livestock. Bears are notoriously fond of pork, mutton and honey. Pig and sheep killers made the raising of these animals almost impossible on the frontier. Even today the bear takes a toll. The loud squealing of a pig as it was borne away initiated many a bear hunt. One of our earlier naturalists, Godman, remarks that bears do not put their prey to immediate death, but tear it to pieces and devour it, without being delayed by the loud screams or struggles. This depredation, while presently less severe than in early days, has placed the bear in ill-repute and some states still place a bounty on its scalp.

For all its great bulk, the bear climbs with astonishing speed. Like a boy shinning up a tree, the black arms circle the trunk while the hind limbs, equipped with sharp, short claws, are drawn under the belly to push the animated bulk skyward. If hunters and their dogs disturb a treed bear, it may drop from a considerable height, landing on the rump and bounding off before the startled hounds can close in. In more leisurely manner it backs down the tree in a slow and deliberate manner. Enemies alone do not prompt the bear to leave the ground. Ripening beech-nuts and acorns are sought among the upper branches, where the fruits are gathered into the paws and stripped from the branches. In the Florida hammocks, the bear will climb into the top of a cabbage palmetto, grasp the big bud in its arms and sway back and forth until the tender morsel loosens, then fall to the ground, the cabbage secured. Drawn to the hidden store of honey, bears will climb a bee tree to feast on the combs. It seems immune to the sharp stings which pierce the lips, gums and tongue.

It is also at home in the water. A powerful swimmer, it sets a straight line from one shore to another. Hunters say it will not deviate from a set course, climbing into a boat if such be in its path.

Many a hunter who has spent years in good bear country has never seen the beast. Few animals have a keener nose, while the small rounded ears can pick up sound at amazing distances. The little pig-like eyes are nearsighted and are surely no great asset to a bear. This was amply demonstrated some years ago when Dr. Francis Harper and I were collecting mammals on the slopes of Mt. Katahdin in northern Maine. A bear was spied some distance away in the brule, and through the glasses it could be observed stripping blueberries from the low bushes. Stalking downwind, I approached within fifteen yards of the bear, whose head was turned from me. One exposure was made with a small camera, whereupon the bear turned to look at me. For half a minute we stared at one another, I too scared to move and the bear trying to make out what manner of creature this was that stood so close at hand. Several times the great beast lifted his nose to sniff the wind, once he opened his mouth and I could see the berry-stained tongue. When finally he caught the hated man scent, he gave an explosive snort and made away. Later in the afternoon Harper and I again came on the bear; once more we were allowed a close approach as he continued to feed. A favorable wind precluded his scenting us and sight was so poor he could not make out the queer bipeds so close. Finally the bear entered a stand of birch, alarming a magnificent bull Moose, who trotted off. I doubt if he had fear of the bear; rather he must have scented us. Later we set up a large camera, on tripod, a string attached to the shutter. The last remnants of our bacon and part of a porcupine were used for a lure. A magnificent self portrait resulted from our efforts, a prize more valued than a dozen bearskin robes.

As the strengthening sun of late winter swells the buds, opens the frozen brooks and brings the early flocks of grackles and redwings in to the north, Bruin bestirs itself. Whether an old male or a she bear with cubs, the urge is on to move from the temporary quarters that winter has imposed. Lean weeks are ahead, for plentiful food will not be on hand until the moon has twice shown its full face. Still fat, the bear must rely on its own reservoir for sustenance. Buds and debris, a frozen carcass or still dormant animal life must sustain it for awhile. Southern slopes

sprout new growth, and the bear at this season is a real grazer, munching the sprouting clover and other greens much after the fashion of a cow. Indeed, grass and other succulents may make up much of its food at this perilous season, for food is hard to come by, and it must take that which the land affords. When northern lakes and rivers give up the drowned bodies of mayflies, the shores are windrowed with great piles of the rotting insects. Bears repair to these sites to glut on the decaying mass. They are said to actually swim the lakes with open mouths, devouring the multitudes of these transforming creatures much after the fashion of the great whales. Not till early summer will the bears feed well, when the growing hordes of insects, incipient fruits and berries provide it the needs which such a large body demands. Tubers, roots and even bark make up the dietary of the Black Bear in spring. Summer holds promise of a full table and Bruin makes full use of this bounty. The laden bushes with their ripening fruit are fully utilized. Walter Crissey tells me of seeing a Catskill bear straddle a shad bush thick through as a man's wrist, bend it down and strip the ripened fruit from the branches. I have watched a Maine bear gorge

itself on the red berries of mountain holly (*Nemopanthes*) and turn later to the laden blueberry bushes to fill its capacious maw. In August, 1946, I followed the well marked trail of an Adirondack bear that had partaken freely if not wisely of the black fruits of wild sarsaparilla. The loose droppings, composed of skin and seeds, had acted as a cathartic. Vernon Bailey recounts a similar instance in which a bear had climbed a cascara bush and stripped the limbs of most of their juicy purple berries. The medicinal properties of the fruit had evidently begun to take effect before the bear reached the ground, as the ground beneath the tree and the trail leading away from it indicated. At this season it may come on a bee tree or a "cultivated" apiary and feast on the sweetness, bawling the while it receives the stings. Yellow jackets and their combs are clawed from the subterranean chambers and avidly consumed. Fresh leaves, grubs and the hordes of crickets and grasshoppers help to sate the ever-

A snugger spot for spending the winter could scarcely be found. This photograph, from the Pennsylvania Game Commission, shows a dormant Pennsylvania Black Bear holed up in a cavern under a tangle of roots.



growing appetite. The bear must surfeit itself in the land of plenty, for lean days are ahead.

Autumn provides a bounty for many animals, including man. Few species profit so much as Bruin, for this is the season of plenty. Mast is abundant, the acorns, beechnuts and late fruits providing a table for the gourmet. Like a boar rooting the ground, the big black fellow does not disdain any edible bit that comes within reach of its probing nose or tremendous claws. The season of harvest is at hand, and the bear must gorge and fatten without delay.

In the northern states, winter snow and zero temperatures end the food supply; the bear must migrate or seek a shelter in which to pass the bitter months ahead. A windfall, a canopy of spruce boughs, or an upturned root will do. Whether male or female, the bear has little regard for the zero temperatures of our northern winters. It is surely not a hibernator. It does not indulge in the deathlike sleep of the woodchuck, whose body temperature may drop to near the freezing point, the heartbeat retarded and a pulse that is difficult to record. On the contrary, most bears in winter quarters (except a nursing female), are alert and off at the first intimation of danger. Experienced hunters and their well-trained dogs find it no easy matter to run down a bear driven from its snowy bed. Occasionally the bear makes little provision for its winter den site, choosing an open swamp and gathering together a few twigs to form a loose mat. Snow may cover the dormant animal, matting on the long hairs. So well insulated by a thick layer of fat that little heat is lost, the bear drowns away the long winter months, subsisting only on the internal store of fat which the black robe covers. Occasionally the males will make short forays, but little food is taken on these travels.

Summer is the season of love, the bear mating in late June or early July. After a gestation approximating seven months, the one to four young (usually two or three) are born in late January or February. The cubs are remarkable for their diminutive size, the new born youngsters weighing but eight to twelve ounces. No larger than a guinea pig at birth, they manage well in spite of the zero weather about. If we were born in such proportions, what a time the newspapers would have! Yet many female Black Bears weigh

little more than an expectant human mother. The cubs nuzzle the mother's breast for the rich milk that will nurture them for the long winter and early spring months.

The phenomenal ability of the female to nurse her several cubs for a two- or three-month period, all the while she abstains from eating, is one of the remarkable enigmas of nature. How rich the milk must be to fatten the cubs during the mother's long abstinence! It was the desire to secure milk samples for analysis and to obtain young cubs for a study of tooth and bone development that a party was organized in the winter of 1951. J. R. Matson of Perry, New York, probably the greatest authority on the Black Bear, headed an expedition into upper Michigan when word was received that a bear with cubs had been located. The youngsters were brought back to New York, and for five weeks my family and I played host to the three cubs. It was an experience none of us are likely to forget. When the youngsters left us for larger quarters, our house was a shambles and evidence of their claws and teeth, impressed on us and the furniture, still remain. It was an unparalleled opportunity to study cub behavior and observe the changes that transpire so swiftly in growing cubs.

Twins or triplets, often a heavier burden, imposes a strain on mother. She herds the brood through the summer, often into the fall, and discourages the advances of any prospective consort while family duties occupy her time. Hence the wild bear mates every other year. If some mishap takes her cubs, and she is free from parental duties in the early summer, she may accept the advances of a prospective mate and produce a litter in the winter ahead. On this score, naturalists are not agreed. Captives frequently produce an annual litter, but we suspect one family every other year is the rule among the wild beasts.

It is gratifying to know that the Black Bear is still with us, even increasing on a range where it was once decimated by the early hunters. It is more than probable that it will continue to re-establish its home in haunts long deserted. While Bruin may still rob us of an occasional sow or lamb, we can tolerate this lapse from the normal good behavior. He is a real heritage of our American wilderness.



Three types of Goldfish: Top — one of the wild specimens; Below, Left, a young Oranda; Right, the Eggfish.

ALL GOLDFISH ARE NOT GOLD

By JAMES W. ATZ

SINCE Darwin's time natural selection has been recognized as one of the fundamental forces of nature. We seldom have an opportunity to see it in operation, however, because its effects are generally revealed so slowly.

A good demonstration of the power of natural selection was recently brought to light at the Zoological Park when Lake Agassiz was drained last December, preparatory to the cleaning and deepening of its basin. As the water level fell, members of the Park's Plumbing Shop, which had been assigned the job of draining the lake, noticed that a number of fish had become trapped in one of the remaining pools of water and mud. The Aquarium was asked whether any of the trapped fish were wanted for exhibition in the

Lion House. Fishes collected in the Zoological Park have regularly been exhibited at the Aquarium — Carp from the Beaver Pond and various sunfishes from Heart Lake, for example — and the plumbers and their helpers were commissioned to catch as many as they could. The mud was deep and collecting was not easy, but the men returned with a score or more of lively specimens about seven inches long.

Since the fish were colored like Carp and since Carp abound in the waters of metropolitan New York, it was assumed that they all belonged to that species. A closer look, however, revealed that practically all of the leaden or dull bronze fish were actually Goldfish which had assumed the color of their wild ancestors.



The large fish in the center is a Carp, and the other fish are wild Goldfish; the head of the Carp is noticeably much sharper.

Wild Goldfish still exist in the lakes and streams of southern China. They are not striking fish, but once in a while a golden colored one occurs — a sport, or mutant as the geneticist calls it. It was from such fish that the Chinese, at least a thousand years ago, began selectively to breed the Goldfish and develop the lovely orange and red specimens so familiar to us today. Nevertheless, despite all these years of selective breeding, the ordinary domesticated Goldfish does not “breed true.” From each spawning of a pair of fancy Goldfish, many young must be culled because they do not have the desired shape of body or fins or the proper color. Almost always some of them show the dull coloration of their wild ancestors.

When fancy Goldfish are liberated in some pond, stream or lake, just as they were put into Lake Agassiz some time in the past, the situation is quite different. Instead of the artificial selection of the fish culturist or fancier, who weeds out the wild types and carefully nurtures the beautiful and bizarre ones, natural selection decides which fish shall survive. Against the natural dark background of silt, dead leaves or aquatic plants, the golden colored individual stands out sharply, a conspicuous target for some fish-eating bird, wide-gaped frog or predacious fish. Moreover, experiments have shown that red or orange colored Goldfish do not avoid dark backgrounds,

as fish ordinarily do when they are light colored. In fact, they definitely prefer darker backgrounds to lighter ones.¹ It is as if they do not realize that their color is different from the ancestral hue and tone.

Thus few if any small fancy Goldfish survive in nature. It is also apparent that any attempt to “improve on nature” by planting fancy Goldfish in streams and lakes is doomed to failure. If the fish do become established, only the dull colored ones eventually survive. Goldfish are also undesirable because of their grubbing habit of feeding. They frequently make the water into which they have been introduced unsuitable for more valuable native food and game fish.

In the United States feral Goldfish were found in the Schuylkill River as early as 1858, and the species now exists in most states from New Hampshire and Florida to California. Early in the century a peculiar fish appeared in the markets of Washington, D. C. Fishermen called it Sand Perch and used it as a cheap food fish. Sand Perch, it turned out, were simply Goldfish that had accidentally been introduced into the Potomac, had in time “reverted” to the wild type and reached the large size, ranging up to two feet, that the species sometimes attains in nature. It used to be a favorite joke at the old United States Bureau of Fisheries to send some budding

¹ Breder & Halpern, *Physiol. Zool.*, 19 (2) : 154-190, 1946.

ichthyologist down to the Washington markets to try to identify the Sand Perch. Goldfish have also been introduced into Europe, Hawaii, Australia and much of the Orient. Practically all of the fish in these feral populations now look like the rather nondescript wild Goldfish from which they originally sprang.

One of the common misapprehensions about Goldfish is that they are simply a golden variety of Carp. The truth of the matter is that they are two entirely distinct species, although they belong to the same Family of fishes and can be hybridized. Anyone seeing a Carp and a wild Goldfish together will readily note the difference between them. The Carp, *Cyprinus carpio*, has a more rangy body and a more pointed profile than the Goldfish, *Carassius auratus*. In addition it has two pairs of worm-like barbels at each corner of its mouth; these are lacking in the Goldfish. There are also a number of differences in

internal anatomy. One reason for the confusion between the species is that the Goldfish used to be called the Golden Carp, even though it was recognized as a distinct species at the time. Another source of confusion is that yellow sports or mutants also occasionally occur in the Carp — true golden Carp, which are artificially cultivated in ponds in the Far East both as food and decorative fish.

Fortunately there was one Carp among the fishes collected in Lake Agassiz so that visitors to the Aquarium are now provided a graphic demonstration of the differences between these two species. They are also provided a dramatic example of the power of artificial and natural selection, for next to the tank of wild Goldfish is an aquarium filled with fancy ones: Orandas, Comets, Moors, Shubunkins, Eggfish, Telescopes, Fantails and Lionheads, all of them a far cry from the dull, ordinary shaped "ancestral" fish.

News from the Conservation Foundation

Davis and Stern are Back from Field

Dr. Kingsley Davis, until recently on leave for field population studies in Africa, has returned and again resumed his work at Foundation headquarters.

Peter Stern of the Research Department returned from Guatemala shortly before the first of the year. He reported to the staff on various aspects of his field trip with technicians working on our Soil Erosion Survey in Latin America. It is expected that this survey will be completed shortly.

Our Industrial Friends Attend Annual Dinner

The third annual dinner in honor of the industrial organizations which have shown an interest in the Conservation Foundation was held at the University Club on the evening of December 16. Those present included Colonel Edward F. Brown of National Dairy Products Corp.; Mr. David Shepard, Standard Oil Company of New

Jersey; Mr. F. G. Jewett, American Can Company; Dr. Arnold Zurcher; Mr. Vernon Crudge; Mr. Edward Green; Mr. Dana Creel; and Messrs. Osborn, Rockefeller, Smith, Brewer and Carlisle of the Conservation Foundation.

Progress of the Foundation over the past year was discussed and future plans were described. Our industrial friends made a number of suggestions of ways in which they think that industry can help forward resource understanding on the part of the general public.

Study of Flood Control Programs and Policies Sponsored by the Foundation

Programs for flood control in the United States have, until recent years, involved primarily major dams, levees and other protection works on large rivers. Public recognition of conservation measures including land use treatment and small structures has resulted in a change in public policy recognizing upstream works as an important factor in basin planning. However, the entirely

different approach, philosophy and techniques required for planning and evaluating the upstream measures for flood control have led to major differences of opinion regarding the efficacy of such upstream works and their relation to main-stem structures.

These differences of opinion probably would be easily resolved if adequate basic data were available for all the engineering and economic studies required. The gaps in basic data will be filled only after years of research. Formulation of new policies and revision of existing policies will almost certainly be necessary under the pressure for development of flood control programs, long before these gaps in knowledge are filled. For that reason, an objective analysis and review of the controversial aspects of these programs may be an important helpful step in influencing such policy determinations. It should at least provide voter, legislator and technician with a summary of the real issues and a framework for a better understanding of what constitutes flood control.

The Conservation Foundation is sponsoring such a study. The end result is visualized as a book, solidly based on fact, but presenting in summary form both sides of the controversial

questions. Two main subjects will comprise the bulk of the report, 1) A comparison of procedures and philosophies used by the Corps of Engineers and the Department of Agriculture in planning and evaluating their respective programs; 2) A summary of the basic data which form the basis for determining the effects of watershed treatment on floods and for the planning of major structures.

Analysis of these two main subjects should bring out the main points at issue. Though it is not the purpose of the report to make definite recommendations regarding policy, a better understanding of the problems concerned with integrating downstream and upstream work should be helpful to policy-makers as well as to the general reader. The types of basic data needed but not now available will be treated in such a report. The study should thus point the direction for further research in the effects of upstream engineering measures on various phases of the flood problem.

Technical help as required has been offered by the Corps of Engineers and the Department of Agriculture. These agencies have assured the Conservation Foundation of their interest in seeing such a study made.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Doctoring at a Distance — and a Warm Letter

What to do about a 35-year-old elephant's intestinal parasites? The question was put up to Dr. Goss recently in a letter from Mrs. Karl L. Rankin, wife of the Chargé d'Affaires in the American Embassy at Taipei, Formosa.

The elephant belongs to General Sun Li-jen and is the sole survivor of five elephants that accompanied the General's Chinese troops from Burma back to China over the Burma Road at the end of the war. The others died of parasites, and the survivor is afflicted with them, Mrs. Rankin wrote. The elephant is a favorite among the soldiers and the American community wants to do all it can to save it.

In his reply, Dr. Goss explained the difficulties of treating an animal without knowing more about its size, general condition, the kinds of parasites, and so on. He asked that a local veterinarian or physician make certain examinations and send him a report, whereupon he would be able to suggest medication and if necessary send the appropriate drugs.

Enthusiastic praise for the Zoological Park was contained in another recent letter, from Mr. K. A. Bolgen of Newburgh, New York. "Your Zoo is a great and satisfying experience," he wrote. "I am speaking as a practicing psychologist who has spent much time with the study of animal psychology. The serenity and perfect adjustment of these happy captives is something to gladden

the heart of the expert. I have never seen anything to equal your big cats; and it always aggravates me to know that the general public can never fully realize the extent to which they represent a triumph in the relationship between man and animal, captor and captive."

We Are Getting Reports from Our Duck-banding Activities

Duck-banding activities have been carried on in the Zoological Park since 1932 under the auspices of the Fish and Wildlife Service, Department of the Interior, and have contributed greatly to their studies and investigations of the migrations and life histories of the birds of North America. Reports which we have received from them on some of our band numbers have been extremely interesting. On January 20, 1951, a duck that we had banded on November 14, 1934, was picked up dead in Secaucus, New Jersey, giving the bird a known age of at least seventeen years. On January 27, 1950, we banded three male Black Ducks with Fish and Wildlife Bands 507-42161-2-3. In September of that year, the first of these birds was shot on the St. Lawrence River in Canada; No. 507-42162 was shot by an Indian during "last of May" 1952 at Factory River, James Bay Area, 78° W. Longitude, 52° 30' N. Latitude, Canada; and on October 10, 1951, No. 507-42163 was shot at Pointe Aux Trembles, on the St. Lawrence River, Quebec, quite definitely indicating a consistent flight pattern. It is a strange coincidence that three birds banded consecutively on the same day should all have been reported, while twenty-two other ducks banded the same day remain unreported. — R. M. McC.

Camera Presented to Dr. Beebe

For many years the Ernst Leitz Optical Works of Germany has followed the custom of presenting cameras with serial numbers at intervals of 25,000 to well-known scientists. Dr. William Beebe has now been informed that Leica camera No. 600,000, with a Leitz Summarit 5 cm lens 1:1.5, has been set aside for him, in appreciation of the excellent photographs that have illustrated his work in zoology.

The most recent previous presentation was of camera No. 575,000 to Dr. Albert Schweitzer of Lambarene, French Equatorial Africa. Among

other presentations were those to Sven Hedin and Dr. Wilhelm Filchner for their explorations of Asia, Prof. August Piccard for his explorations of the stratosphere, Dr. Leo Frobenius for his explorations in Central Africa, and L. Godowsky and L. Mannes for their invention of the kodachrome process.

Alligator Snapping Turtles Presented to the Zoo

Two large specimens of the Alligator Snapping Turtle, *Macrochelys temminckii*, have been presented to the Reptile House collection by Dr. Fred R. Cagle, chairman of the department of zoology of Tulane University. The largest weighs 85 pounds, the smallest 55, and the shell of the larger specimen is around two feet in length. Large as it is, it is still far from its full growth; specimens have been reported weighing about 400 pounds.

This largest freshwater turtle in the world is notable for the fleshy projection on its tongue, used as a lure for fish. Curator Oliver believes that it will be possible to demonstrate the lure when the turtles are put on exhibition in tanks on completion of the Reptile House remodelling.

The Timeless Tuatara

(Continued from Page 8)

us is that it appears to be active and ready to take food at both higher and lower temperatures within the environmental range. Few reptiles can be induced to feed at temperatures much lower than 70° Fahrenheit. Our Tuatara takes its food just as readily at 55° Fahrenheit as it does at 70° Fahrenheit. However, it is doubtful that it would eat as frequently at the lower temperature as it would at the higher one.

Our specimen has been with us only two months to date. It has gained two ounces in weight and has increased its over all length by about a half an inch. It has shed its skin once since its arrival and appears to be in a very healthy state. Contrary to some published reports, our specimen is fairly active. We hope that by continued careful observation we shall be able to learn much about the behavior of this truly interesting zoological curiosity.

PUBLICATIONS OF INTEREST

MARINE GAME FISHES OF THE WORLD. By Francesca LaMonte. 190 pp., 80 drawings in color and 67 in black and white. Doubleday & Co., New York, 1952. Price \$3.50.

The combination of a wide scientific knowledge of the various fish groups, the more specialized knowledge of the taxonomically difficult and important big game fishes and the still more specialized knowledge of the angler's point of view would seem almost an impossibility to achieve. Francesca LaMonte, Associate Curator of Fishes of the American Museum of Natural History and Secretary of the International Game Fish Association, does achieve it, however. The result is a most fortunate book for the salt water angler of any kind in any part of the world.

Following a pattern proved successful in her earlier "North American Game Fishes," but somewhat more detailed, the book covers an astonishingly large range and is so planned that the basic natural history and angling information on practically all marine game fishes are quite literally at the reader's finger tips.

The illustrations are comprehensive and well done by Janet Roemhild, certainly a competent craftsman and one of the finest fish artists living. The ancillary sections, which list the all-tackle record fishes of the I.G.F.A. and all sorts of vital fishing data — such as the kind of weather or waves one may expect at a given area and season, and whether or not boats and gear are available — are alone worth the price of the book to anyone interested in fishing. From the handliners of Coney Island to big game anglers fishing from luxury launches off New Zealand, and not excluding professional ichthyologists, all can read and use this book with profit. — C. W. C.

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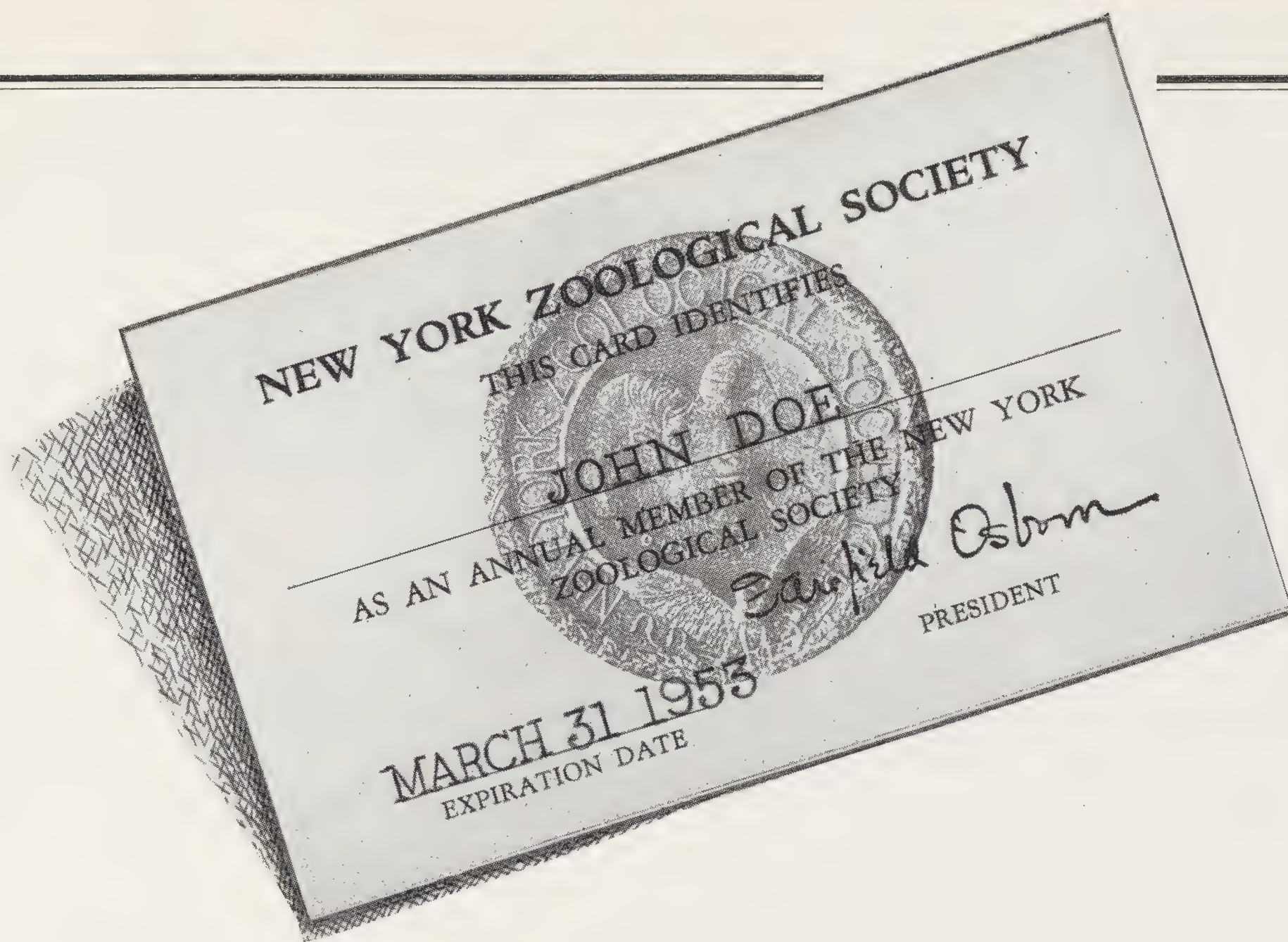
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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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The Seeing Eye

THE QUESTION IS — WHO SEES WHAT? Birds can see more acutely than we, reptiles gaze more steadily, fishes — well, we don't know too much of the vision of fishes except that the eyes of most of them never close!

As to mammals, man seems the best equipped with sight — three dimensions, color and all! However, it is not of visual perception as such that we are now thinking. It is of that gift man alone possesses, not only of seeing the object but of thinking at the same instant of what the object means. This is an infinitely precious capacity that nature has bestowed, a rich partnership between eye and conceptual power. There are people, unhappily, who seem unaware that this partnership exists. They look at an object, almost as a fish might, and that is the end of the matter. Others are in the border state — they see and think a little. Finally, there are the truly blessed who look at everything with the "seeing eye." With them there is no end to the riches they draw from their visual experiences.

One of these endowed people, it might be remarked, is the author of the article on Simla in this issue. He is an ideal example of one who sees more the more he looks.

Fairfield Osborn

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DEER: THOSE ADAPTABLE ANIMALS

By ROBERT M. McCLUM



DEER HAVE ALWAYS FORMED an important part of the New York Zoological Park's animal collections, and no fewer than 42 different forms have been exhibited here. In size ours range from the tiny Reeves' Muntjacs and Chinese Water Deer, full-grown adults of which stand approximately 16 inches high at the shoulders and weigh 15 to 20 pounds, to a fine bull American Moose, which towers over the observer and probably weighs close to 800 pounds. The native lands of our present collection range from Japan and the battlegrounds of Korea to the jungles of Malaya and through the forests of Europe and Canada to our own Rocky Mountains.

The deer family is an extremely adaptable one, representatives being found from the cold Arctic tundras to hot and steamy jungles. Nearly sixty distinct species are presently recognized, with several times that number of sub-species.

Today the great Eurasian land mass is the home of the greatest number of forms, with the Americas not far behind. Two continents, Africa and Australia, are almost entirely lacking in a deer fauna. Africa, the present center of the antelope tribe, has only one native deer, the Barbary Stag, while Australia, the longest-isolated of all the continents, never had any native deer or hoofed animals of any kind. Here the marsupials or pouched mammals took over, and kangaroos evolved as the dominant grazing and browsing animals. The earliest known deer are fossil remains of small creatures without antlers which lived in Europe some 40,000,000 years ago. In the next 10,000,000 years these primitive deer differentiated, some developed antlers, and at various times some traveled to America by means of a Siberian-Alaskan land

bridge. There were successive migrations to America up until recent times.

The one characteristic which most easily separates all present-day deer from other split-hoofed animals is the presence of antlers in the males of all species except the Chinese Water Deer and Musk Deer. Females are not antlered, except in the Reindeer and Caribou. There is an exception to almost every rule!

Antlers — true bone — are normally cast off yearly. They are grown on bony pedicles or protuberances of the frontal bone and are covered with velvety skin, thickly diffused with blood vessels as they grow. When full growth has been achieved, the blood supply ceases and the skin or "velvet" dries up and comes off. The buck usually hastens this process by rubbing his antlers against trees or rocks. Antler form may vary in different species of deer from a simple spike, as in the South American Browsers, to the intricate, many-branched antlers of the European Red Deer, or the immense flat weapons of the Alaska Moose. The world's record for Alaska Moose antlers is a rack with a spread of 75 inches, in the National Collection of Heads & Horns in the Zoological Park. Even these, however, are dwarfed by the enormously flattened, heavy antlers borne by the extinct "Irish Elk." This magnificent animal flourished in Europe in Pleistocene times, and many examples of its antlers measure ten or eleven feet from tip to tip. These huge weapons, heavy and unwieldy, are an example of an over-specialization which probably hastened the animal's extinction.

Many species of deer — Caribou and Axis Deer, for example — live the year 'round in herds or family groups. Others, like the Moose, are solitary animals, coming together only at the breeding season, or during the winter. Some deer, such as the Rocky Mountain Wapiti and Caribou, make regular yearly migrations.

ights between White-tail bucks look more vicious than they usually are, although there is a danger of locked antlers. Young bucks may fight in play, or may challenge the supremacy of the herd's leader.

At the breeding season the stags seek out the does, and contests for possession of one female, or to collect a harem, often become vicious fights. That deer are always gentle, inoffensive creatures is a common misconception, for there are many instances of captive deer, does as well as bucks, suddenly attacking a human being with whom they had seemingly been on the friendliest of terms. Bucks especially can be very dangerous animals during the season of rut, with uncertain tempers and command of murderous weapons in their hard, sharp antlers and hoofs.

Deer have been utilized by man from time immemorial. Deer-hunting for food and the excitement of the chase is a sport enjoyed alike by ancient kings and millions of sportsmen today. In colonial America, deer were an easy source of meat for both colonists and Indians. They also provided leather and hides for their clothes. The whole life of the European Lapps revolves around their Reindeer herds — Reindeer mean transportation, meat, milk, shelter and clothing to the Lapps. Wild Caribou are almost as important to various Eskimo tribes of the New World's Far North.

Of all our native deer, the White-tail is without doubt the most abundant and important big-game animal in North America today. Numerous races of the White-tail Deer range from southern Canada south through most of the United States, and much of South America. During the brief hunting season each fall in the United States, the White-tail harvest usually numbers close to a quarter of a million animals, yet this beautiful deer is probably more numerous now than it was in pioneer days. That may be a surprising statement, but the fact is that it thrives in open woodland and second growth, and the clearing of the forests has actually helped it.

The White-tail is one of the most beautiful of all deer, with a satiny chestnut summer coat, and white markings on the throat, nose, around the eyes, and on the rump and under side of the tail. This latter area gives the deer its name, and serves as a recognition patch to others of its kind. It is especially noticeable when the deer, tail high, bounds away from danger. The bucks have distinctive antlers, the main beam curving forward almost horizontally, with tines sprouting vertically from it.

The largest of the many races of White-tail is the northern, ranging throughout New England and New York. A big buck of this form may weigh 275 pounds. The Zoological Park has a fine herd of these animals at the present time. After a White-tail doe has had her first fawn, she usually bears twins. In May or June there is no more beautiful sight in the Zoo than a day-old fawn curled up at the base of a giant beech tree or under a ledge of rock. One must look closely, however, for the fawn's spotted coat blends effectively with the background. Each year newspapers carry accounts of well-meaning people who, coming across a fawn alone in the woods, pick it up and carry it home to raise on a bottle, considering that it has been deserted. Not only is this illegal but it is a mistaken kindness, for the fawn has not been deserted. It is usual practice for the doe to leave her fawn in hiding while she goes off to browse.

In past years we have exhibited various races of White-tailed Deer, but we have never had the tiny form known as the Key Deer, which seldom exceeds 40 or 50 pounds. The range of this tiny White-tail is restricted to certain of the Florida Keys — mainly Big Pine, Big Torch, Little Pine and a few others. There is grave danger of its extinction, for only about fifty specimens are left. Fortunately, through government and private conservation agencies, positive steps are at last being taken to protect these few from poachers, speeding autos and other dangers.

Two close relatives of the White-tail are the Mule Deer and the Columbian Black-tailed Deer, found in our western states. The Mule Deer, while quite similar to the White-tail, differs in its black-tipped tail and antlers that branch equally in a double fork — as do those of the Columbian Black-tailed Deer. The Mule Deer is found in rough, hilly and mountainous country from Canada to Mexico, while the Black-tailed Deer is restricted to coastal areas of central California northward. In past years both of these deer have been exhibited and bred in the Park, although we have none at present.

South America is the home of a number of distinctive and little-known deer. Just as the deer family advanced into North America at various periods across the Siberian-Alaskan land bridge, so they later travelled into South America and

there differentiated. Besides various forms of the White-tail, this region has several genera of deer which are found nowhere else. Largest of these, with double-forked antlers, is the South American Marsh Deer, which is to be found in wooded areas near water from the Guianas to Argentina. The Pampas Deer, with three-pointed antlers, inhabits much of the same range, on

The Mule Deer is a close relative of the White-tail, but is heavier and less graceful and its ears are mule-like in their prominence. Formerly the species bred well in the Zoological Park.

prairies and grassy savannahs. The Guemals, deer with simple Y-forked antlers, live in the Andes, from Ecuador south to Chile. Two other distinctive types are the Brockets and Pudus, both of which have simple spike antlers. The Chilean Pudu, scarcely larger than a jack-rabbit, is the smallest of all deer.

While all the aforementioned American deer are exclusively New World types, the three to be mentioned next — Moose, Caribou, and Wapiti — have very closely related counterparts in the Old World. These three can be considered to have come to the New World from Eurasia in com-

Another relative of the White-tail is the Columbian Black-tailed Deer of the mountainous areas of central California and northward. The black tail of the species is prominently shown.

paratively recent times. Moose, largest of all deer, are characterized by their great size, massive palmate antlers, overhanging snout and pendant "bell" on the throat. The European Moose, or Elk as Europeans call it, is very similar to the American forms, and some zoologists include all of the different kinds of Moose under one species. Largest of this giant clan is the Alaska Moose, which may stand seven feet high at the shoulders and weigh nearly two thousand pounds. The typical American form is smaller, and ranges from Nova Scotia and Maine westward through the Rocky Mountains, and north to the Yukon.

These Pampas Deer of South America were exhibited early in the Park's history. The buck, at the left, has recently dropped his 3-pointed antlers, the scars of which may still be seen.





Moose are the largest members of the deer family and a big bull of the common American subspecies weighs 1,000 pounds or more. In this group the antlers of the young bull are still in velvet.

Reindeer have occasionally been exhibited in the Park, although they do not do particularly well in this climate. In Reindeer as in the Caribou, antlers are carried by both males and females.



At present we have a bull Moose, received in 1947, and a cow, received in 1948, both obtained through the cooperation of the State Game Commission of Maine. We have had five calves born in the Park in the period from 1948 through 1951, but none has survived longer than ten weeks. The hot muggy weather of New York in June, or an unknown deficiency which makes the cow unable to supply enough milk, may be among the reasons for our lack of success in raising Moose calves so far. Certain it is that Moose require

large quantities of browse for their well-being in captivity, while most other deer do well on hay and a grain mixture alone. Cut browse is regularly supplied to our Moose throughout the year.

Moose have great curving hooves, which in captivity tend to "snow-shoe" — keep growing in an upward curve until they may become ten to twelve inches long. This condition has been frequently observed in wild Moose as well. When the hooves of our Moose get too long, as happens yearly, the animals are crated and the hooves cut

and trimmed back, a process to which they submit quietly enough.

Caribou and Reindeer are not represented in our collections, at the moment, although both have been exhibited in the past. They are somewhat difficult to acclimatize, both because of the difference in climate between this area and their native tundras and because the mosses and lichens which supply the bulk of their natural food must be supplanted by hay and grain. A bull Reindeer and three cows were acquired in 1941, and four calves were born, in 1942 and 1943, but none survived to adulthood.

Reindeer and Caribou are the only deer in which the female carries antlers. These are well developed, though usually smaller than those of the males. They have wide, rounded hooves, plus well-developed false hooves on each foot — adaptations for traveling on snow or soft ground.

The American Wapiti is perhaps better known to Americans as the Elk. This name, as was previously mentioned, is properly applied by Europeans to the European Moose, but early colonists carelessly transferred the name, familiar to them, to a different type of animal which they found here. Probably it is too late to eradicate the error, but to avoid confusion, the Shawnee name of Wapiti should be used for our "Elk." The races of American Wapiti are very closely allied to the European Red Deer and to various other large forms of the genus *Cervus* which are found in Asia.

American Wapiti, now confined mainly to southwestern Canada and the Rocky Mountain region around Yellowstone, once ranged across the entire continent, from the Adirondacks, Pennsylvania, and other eastern states, on westward. The eastern form has long since been exterminated. The largest single herd at present, of the Rocky Mountain Wapiti, summers in the mountains of the Yellowstone region. In the winter the animals descend into the southern valleys around Jackson Hole, where hay and forage are distributed by government agencies. A larger and darker form, the Olympic or Roosevelt Wapiti,

Although it is commonly known as the "Elk," a better name for this animal is the Shawnee Indian term "Wapiti." Our herd of Wapiti came from the Jackson Hole region of Wyoming.

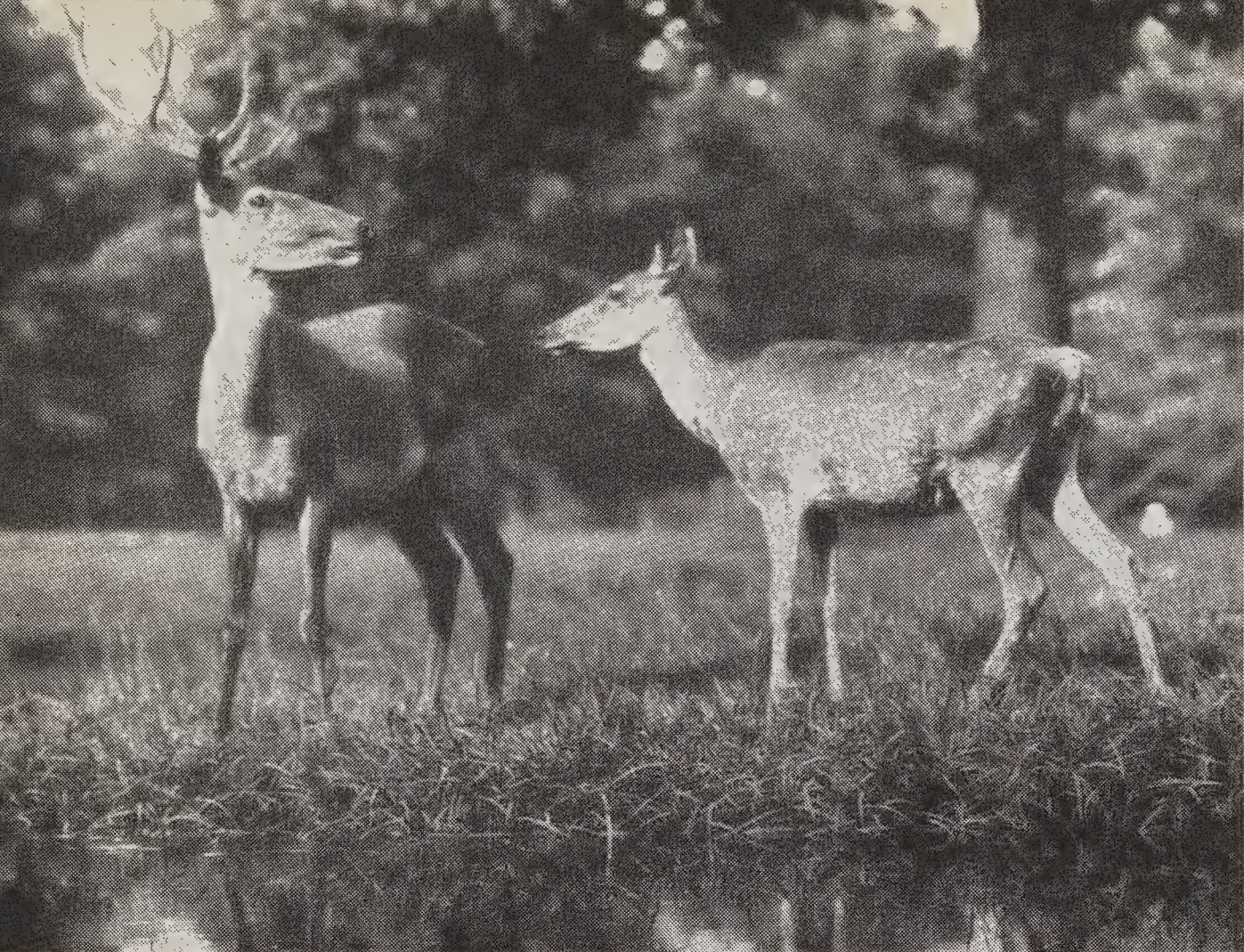
lives in small numbers in coastal forest areas of northern California, Oregon, and Washington.

Very seldom has the Zoological Park been without a herd of Wapiti. Our present herd of Rocky Mountain Wapiti stems from individuals captured at Jackson Hole, Wyoming, in 1947.

The Red Deer is the European counterpart of the American Wapiti. It breeds readily in confinement, and has been successfully introduced into other areas, notably New Zealand, where hybridization has occurred with introduced Wapiti. Closely related forms include the Maral, of the Crimea and Asia Minor; the Hangul of Kashmir; the Tien-Shan Wapiti of the Tien-Shan Mountains in Central Asia; and the Altai Wapiti of Mongolia. All of these forms have been kept at the New York Zoological Park.

The only other deer familiar to Europeans as natives of their continent are the Roe Deer and Fallow Deer. The Roe Deer are quite small, and





The Maral, of the Crimea and Asia Minor, is a relative of the Red Deer that is seldom seen in Zoological Parks. The unusually long face is one of the characteristics of the animal.

are found from England and Scotland eastward across Europe and northern Asia. Only once have we exhibited these deer — two specimens received in 1908.

The Fallow Deer, a small, stocky, spotted deer, was originally found in countries bordering the Mediterranean from Spain to Iran. However, it has been widely introduced, and can be found in a wild or semi-domesticated state in several European and other countries. It is believed that the Romans first introduced the Fallow into the British Isles; today it thrives in parks and forests. Through semi-domestication and inbreeding, various color varieties of Fallow Deer have appeared. The typical summer coat of the original form is believed to be a bright fawn color, interspersed with white spots, with a black line along the backbone. There are also white Fallows, and almost black ones, with all shades in between.

Vividly spotted Axis Deer are among the prettiest of all deer. Although tropical, they thrive here with a minimum of shelter.



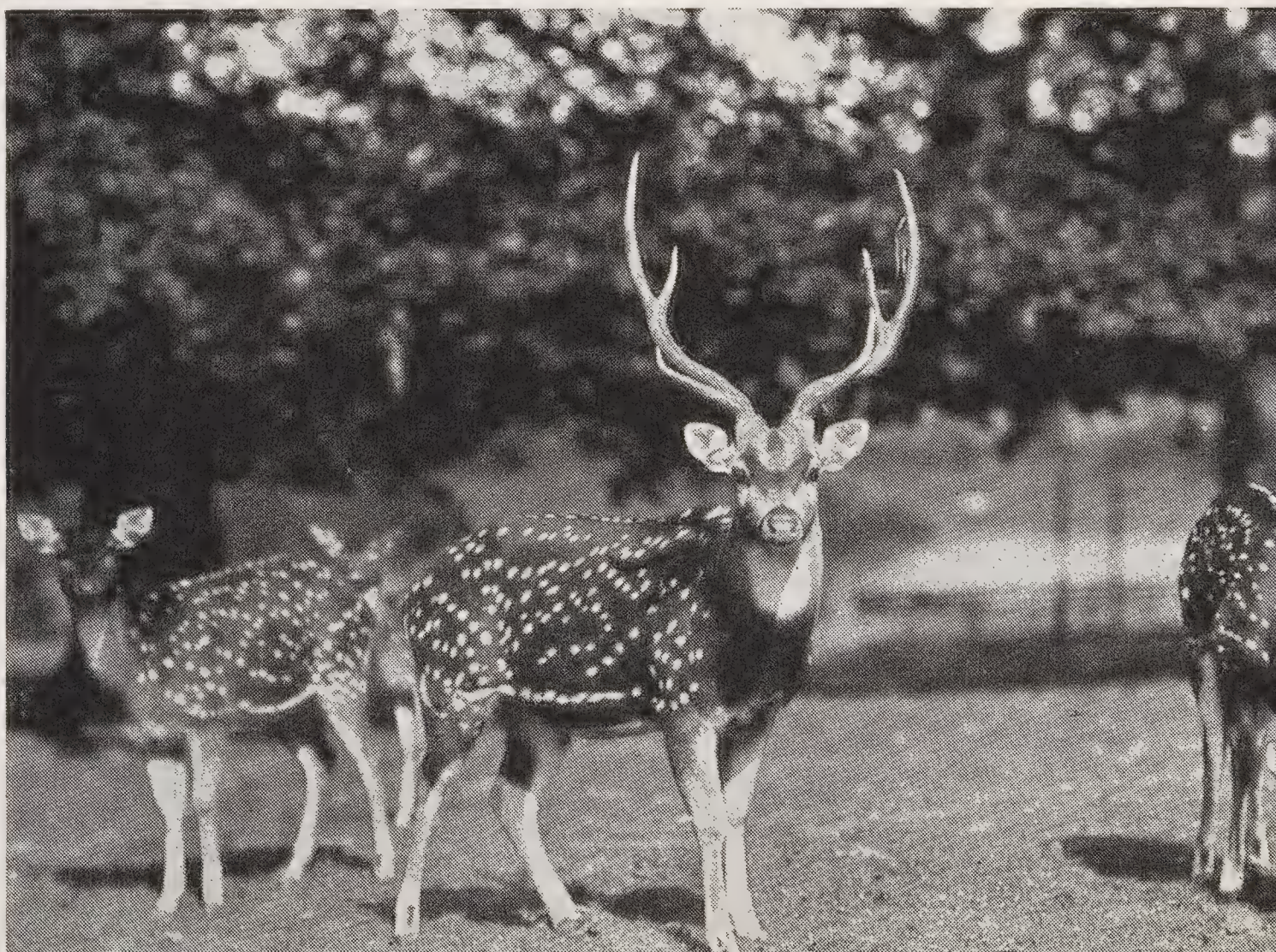
The curved sweep of brow tine and beam in the antlers of Eld's Deer is well-illustrated in this photograph. Such a form is unique among deer. The antlers on this animal are in velvet.

The Barasingha or Swamp Deer is a large species, native to India and Assam. In winter its coat is shaggy and brown, but in the spring this is replaced by a bright orange-brown coat. Even the velvet covering of the growing antlers of the buck is orange in color.

The Eld's Deer or Thamin, native to Burma and Indo-China, is notable for its unusual antlers, in which the long brow tine and the beam form an unbroken, smooth curve, much like the rocker of a rocking chair.

The various forms of Sika Deer are found in Japan, Formosa, Korea and eastern China. They are small, stocky, more or less spotted deer. At present we exhibit three forms — the Japanese Sika, the larger, darker Pekin Sika or Dybowski's Deer, and the Formosan Sika. All of these deer live and breed well in captivity.

One of the most interesting and unusual deer





The Barasingha (native name meaning twelve-tined) is also known as the Swamp Deer. Mainly a grazer, it inhabits grasslands, generally on the outskirts of forests, in India and Assam.



Pere David's Deer, originally from China, is certainly the rarest deer in the world, in that it is known only in captivity. We now have a herd of 10 animals, 6 of them bred in the Zoo.

is the Père David's Deer or Mi-Lou, of which we have a present herd of nine animals, all bred from an original stock of two bucks and two does received in 1946 from the Duke of Bedford's herd in England. Now unknown in the wild state, this deer was discovered by the French missionary, Father Armand David, who in 1865 clandestinely observed the only existing herd in the walled Imperial Hunting Preserves near Peking. Later he was able to smuggle several skins to Europe from which the species was first described. A few living specimens were later sent to European zoos. During the Boxer uprisings in China about 1900, the Imperial Park was broken into, and all of the Père David's deer in the Preserve were killed. During the early part of the century the Duke of Bedford purchased the few specimens that survived in European zoos, seven in all, and kept them on his estate at Woburn Abbey. These

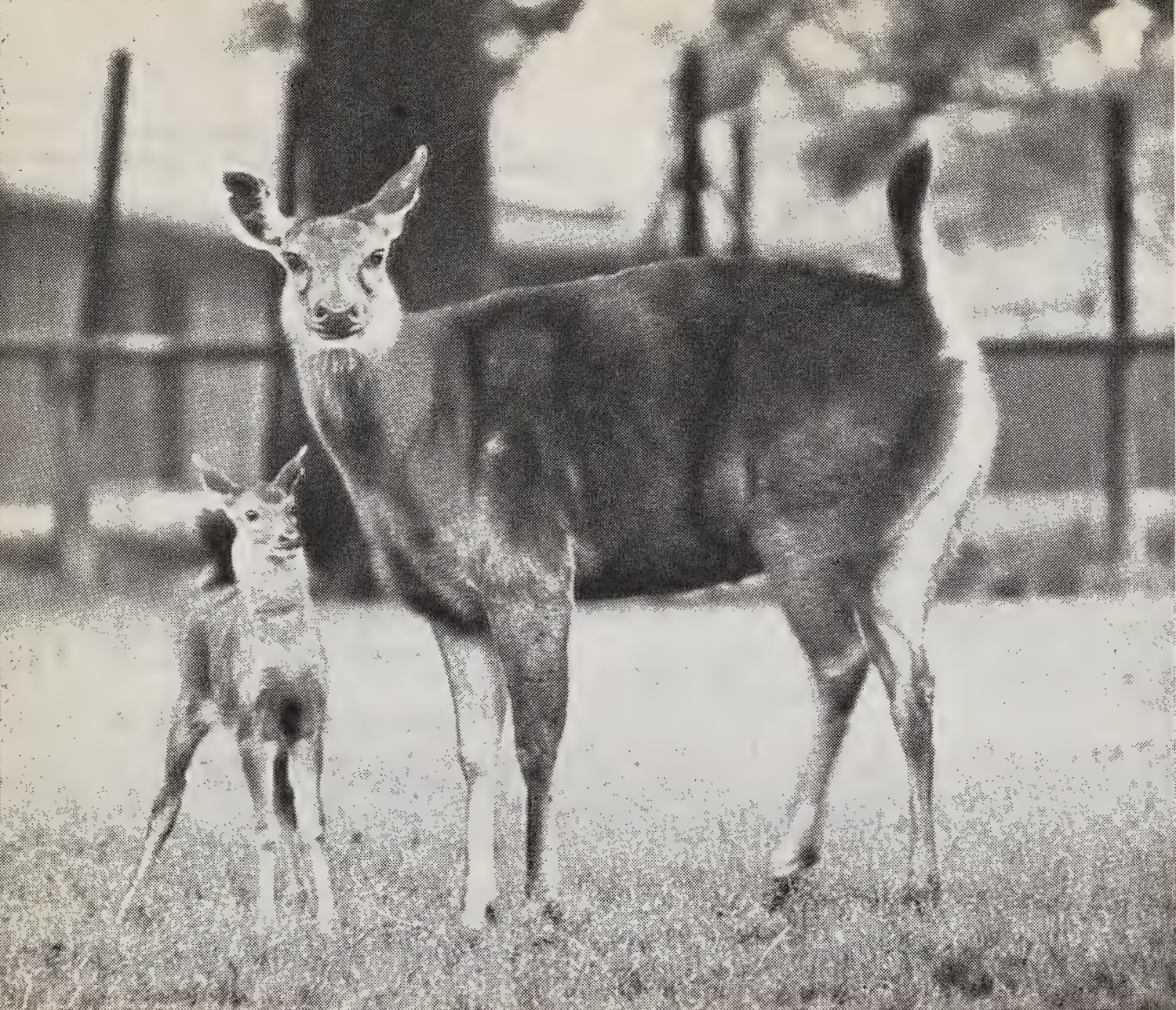
animals formed the nucleus of his present herd of several hundred.

In the winter, Père David's Deer has a dull buffy-brown coat, with a black fringe of long hair along the neck line. In the springtime this is replaced by a smooth reddish coat. Antlers are dropped by the bucks in January, and very soon the new antlers begin to grow, usually reaching their full growth by early May. Later in the month the bucks are in hard antler. The antlers are quite different from those of any other living deer, consisting of two branching main beams, the forward one of which is again forked.

During the season of rut, late June and July here, the large glands below the eye become larger, and the herd buck becomes lean and vicious. At this time most of his coat is shed, and he wallows in the mud, plastering himself with it and digging it up with furious scoops of



The group of Sika Deer is represented in the Zoological Park by three forms at present. This is a trio from our Formosan herd.



The Indian Sambar is the largest deer in its group. Young are often born in the Zoological Park.



The Timor Deer, related to the Sambars, is a rather small animal. It is seldom seen in zoos.



The ungainly Hog Deer gets its name from its hog-like habit of rushing headlong in long grass.

Among the smallest of the deer are the Muntjacs, or Rib-faced Deer. This is Reeves' Muntjac.



his antlers. By his manner he dares anyone or anything to come into his corral, and as he follows the does he bellows in a coughing voice.

One of the prettiest of all the deer is the Axis Deer of India and Ceylon, one of the few which retain a spotted coat through all seasons. Indeed, the Hindustani name for the Axis Deer is "Chital," which means "spotted." Fawns are likely to be born here in any month of the year, and bucks may usually be seen in all stages of antler development. At any given time, one is likely to see several bucks in hard antler, another in which the antlers were just recently dropped, and another with partly-grown antlers in velvet. Axis Deer, although tropical, do quite well in our climate, with only an unheated barn for shelter. They live and breed well, giving difficulty only when it is necessary to capture or crate them, when their highly nervous temperament poses problems. The Hog Deer, a closely allied species, is native to Burma, India, Siam and Indo-China.

The Sambars, of which we have two forms at present, are large and heavy-antlered deer found in India, southeast Asia and certain of the islands. The Indian Sambars, of which we have a herd, are large, dark deer. The bucks have heavy blunt antlers, each antler with a brow tine and a



Another very small species is the Chinese Water Deer, in which the bucks lack antlers. Fawns are so tiny that we often have difficulty in making a fence tight enough to confine them. Right: Keeper Curran steadies a new-born fawn.

forked beam. When alarmed or suspicious, the Sambar is a formidable-looking animal, with tail erect and hair raised all over the body.

Various forms of the Rusa, quite closely related to the Sambars but smaller, inhabit some of the islands off the coast of southeast Asia — Sumatra, Java, Timor, Molucca and the Philippines.

Among the smallest of deer are the Muntjacs. They are also known as Rib-faced Deer because the antlers of the bucks — simple spikes with perhaps a very short brow tine — are carried on long, skin-covered pedicles. There are several species, of which we have kept the Indian Muntjac and the Reeves' Muntjac. At present we have a thriving herd of 22 of the latter. Young are likely to be born here at any time of the year.

The Chinese Water Deer and the Musk Deer are very small deer too, and are the only deer in which the bucks lack antlers. Instead, the males have greatly elongated upper canine teeth which project downward on either side of the lips. Our Chinese Water Deer, native to the marshes of the Yangtze, are presently quartered with the Père David herd. Although it has repeatedly been stated that this species bears litters of young sometimes numbering five or six, this has not been the case with ours. Of fourteen young born here since 1946, the majority have been single births with several sets of twins. At birth the young is so small that it can easily be held in the palm of one's hand.



DEER WHICH HAVE BEEN EXHIBITED IN THE NEW YORK ZOOLOGICAL PARK

* Denotes forms in the collection now

- | | |
|---|---|
| Indian Muntjac
<i>Muntiacus muntjak</i> (Zimmerman) | Eld's Deer
<i>Cervus eldi</i> M'Clelland |
| *Reeves' Muntjac
<i>Muntiacus reevesi</i> (Ogilby) | *Père David's Deer
<i>Elaphurus davidianus</i> Milne-Edwards |
| *Fallow Deer
<i>Dama dama</i> (Linnaeus) | Eastern White-tailed Deer
<i>Odocoileus virginianus virginianus</i> (Boddaert) |
| *Axis Deer
<i>Axis axis</i> (Erxleben) | *Northern White-tailed Deer
<i>Odocoileus virginianus borealis</i> Miller |
| Hog Deer
<i>Axis porcinus porcinus</i> (Zimmerman) | Florida White-tailed Deer
<i>Odocoileus virginianus osceola</i> (Bangs) |
| *European Red Deer
<i>Cervus elaphus hippelaphus</i> Erxleben | Texas White-tailed Deer
<i>Odocoileus virginianus texanus</i> (Mearns) |
| Hangul
<i>Cervus elaphus hanglu</i> Wagner | Arizona White-tailed Deer
<i>Odocoileus virginianus couesi</i> (Coues & Yarrow) |
| Maral
<i>Cervus elaphus maral</i> Gray | Sinaloa White-tailed Deer
<i>Odocoileus virginianus sinaloae</i> Allen |
| Altai Wapiti
<i>Cervus elaphus asiaticus</i> Lydekker | Mule Deer
<i>Odocoileus hemionus hemionus</i> (Rafinesque) |
| Tian-Shan Wapiti
<i>Cervus elaphus songaricus</i> Severtzov | Columbian Black-tailed Deer
<i>Odocoileus columbianus columbianus</i> (Richardson) |
| Tashkent Wapiti
<i>Cervus elaphus bactrianus</i> Lydekker | Red Brocket
<i>Mazama rufa</i> Illiger |
| *Rocky Mountain Wapiti
<i>Cervus canadensis nelsoni</i> Bailey | Peruvian Guemal
<i>Hippocamelus antisensis</i> (d'Orbigny) |
| Olympic Wapiti (Roosevelt Wapiti)
<i>Cervus canadensis occidentalis</i> (Hamilton Smith) | South American Marsh Deer
<i>Blastoceros dichotomus</i> (Illiger) |
| *Japanese Sika
<i>Cervus nippon nippon</i> Temminck | Pampas Deer
<i>Ozotoceros bezoarcticus</i> (Linnaeus) |
| *Formosan Deer
<i>Cervus nippon taiouanus</i> Blyth | *American Moose
<i>Alces americana americana</i> (Clinton) |
| *Dybowsky's Deer
<i>Cervus nippon hortulorum</i> Swinhoe | Shiras Moose
<i>Alces americana shirasi</i> Nelson |
| *Indian Sambar
<i>Cervus unicolor unicolor</i> Kerr | Reindeer
<i>Rangifer tarandus tarandus</i> (Linnaeus) |
| *Malay Sambar
<i>Cervus unicolor equinus</i> Cuvier | Woodland Caribou
<i>Rangifer tarandus caribou</i> (Gmelin) |
| Moluccan Deer
<i>Cervus hippelaphus moluccensis</i> Quoy & Gaimard | Newfoundland Caribou
<i>Rangifer tarandus terraenovae</i> Bangs |
| Timor Deer
<i>Cervus hippelaphus timoriensis</i> Blainville | *Chinese Water Deer
<i>Hydropotes inermis</i> Swinhoe |
| *Barasingha
<i>Cervus duvauceli</i> Cuvier | Roe Deer
<i>Capreolus capreolus</i> (Linnaeus) |



What is the color of a Fallow Deer? Here are three types—the spotted, the dark and the white. All were born in the same herd.

ON A RAINY DAY IN SIMLA

By WILLIAM BEEBE

Dr. William Beebe is one who knows how to turn apparent defeat into victory. According to his custom, he has been forwarding monthly reports from the Department of Tropical Research laboratory at "Simla," in the Arima Valley of Trinidad, for the information of the Zoological Society's officers. The first reports were vivid but routine: the mountains bursting with birds and blossoms, 300 Giant Orioles flying past at sundown, last year's dormitory of red-and-black Melpomene butterflies rediscovered, two invasions of army ants, and so on.

Then a period of daytime rains began and one out-of-doors project after another was rained out. Work in the field, away from the laboratory table, is so vital that the rains would seem to be a major catastrophe. But not at all. . . .

IT WAS DUE ENTIRELY to an unseasonable shower that I was able to learn the secret of what might be called The Acquisition of Stickiness by New-hatched Reduviids. Driven into the laboratory by a steady, windless rain, I found a bit of leaf on my table with a small spot in the center, which someone had brought in from the jungle. Under the microscope the spot resolved into seventy-odd insect eggs, which had been deposited in a solid, circular mass on the under side of the leaf. The basal part of the eggs around the outer rim was covered with a dark, mahogany-red, sticky varnish. This seemed reasonably a defence against peripatetic enemies. The egg caps were pale ivory, each with a single dark spot.

When first observed, one of the egg caps was off and the first of the young reduviids protrud-

ing. (This is the place to explain that this insect is related to our northern Assassin or "Kissing" Bugs, which spend their lives walking about our gardens. They impale small insects on their beaks, and occasionally inflict painful wounds on incautious humans.)

The young bug was pale amber, wrapped up tightly, pupalike, and ascended gradually into view. This would have been reasonable if the insect had been in its correctly oriented position, when gravity could have assisted the emergence. But as I watched, the swathed form rose steadily, with no apparent means of propulsion. When extruded full height, the legs and antennae gradually freed themselves, the elongated body bent over, and the little creature stood upright and took its first step. The third step was almost fatal, for it was directly in the center of the soft, sloping talus of sticky varnish. As if in quicksand, the insect seemed about to be mired, but exerting all its strength it pulled free, dragging out fine threads of the substance, and gained a foothold on the outside leaf tissue beyond the treacherous periphery of the egg mass. Some time later I saw that three more had hatched, two of which appeared to be in serious difficulty in the morass. It seemed as if the elaborate protection to the eggs had back-fired in this subsequent crisis. The moat of stickiness, which must have been of material help in fending off attacks upon the unhatched embryos, appeared to offer a substantial obstacle to the successful passage to life on the part of the newly hatched Reduviids. Three out of the four appeared to be spending all their energy in an attempt to free themselves from the tarbabylike, adhesive encumbrance.

(Note: I wrote the above paragraph after watching four of the insects hatch, then devoting only ten minutes of intermittent observation to subsequent activities. It is a striking example of completely erroneous interpretation based on brief, unconnected observation.)

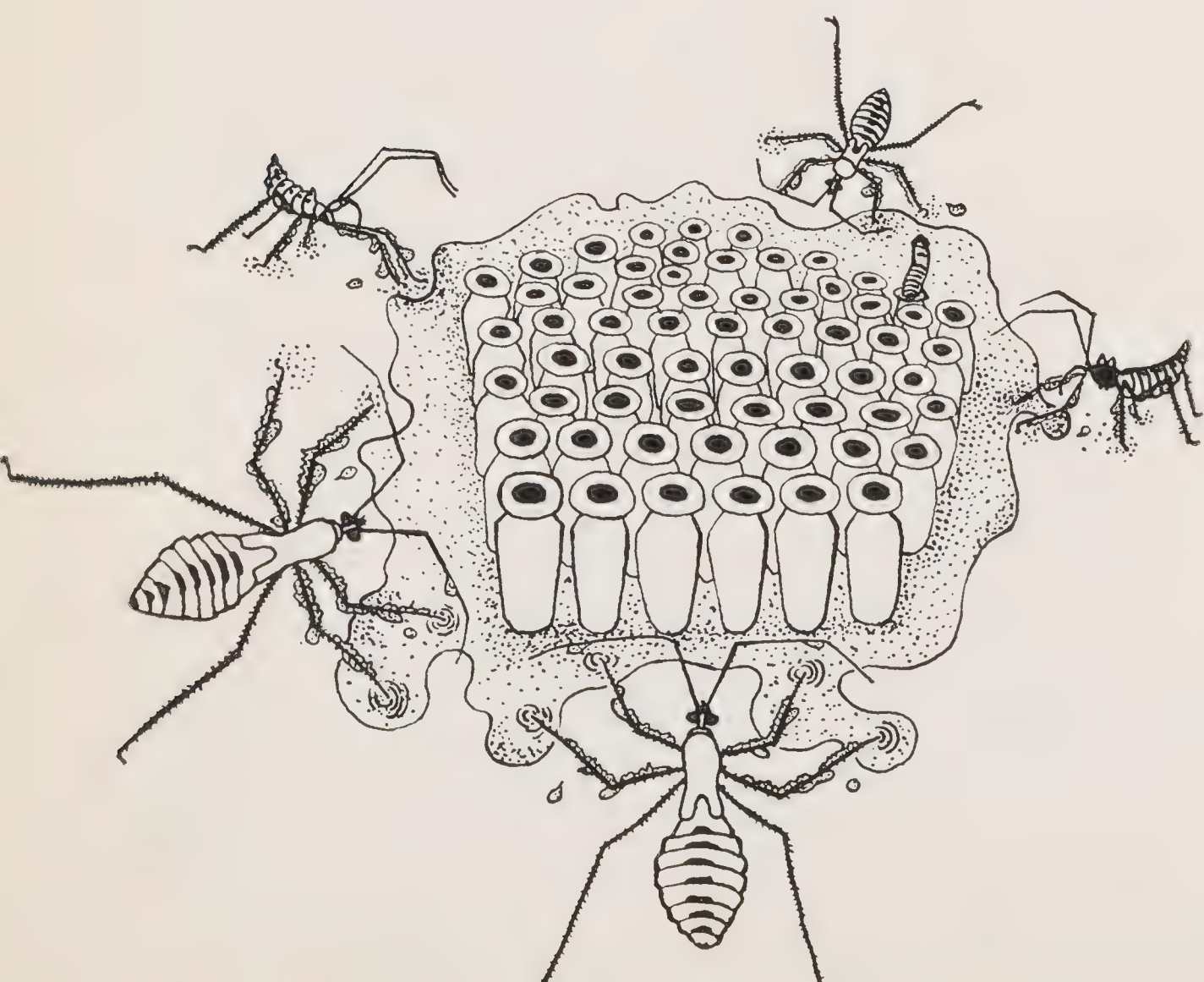
Fifteen minutes later I again sat down to the microscope, to a sight which at once shamed and delighted me. Eight juvenile Assassin Bugs had emerged, the first four now being considerably darker. A ring of six of the little creatures surrounded the mass of eggs, all busily, intentionally, and deliberately anointing themselves with the sticky mucous which coated the sloping outer

bastions of the egg fortress. There is no doubt that any foraging ant or other predaceous insect would find it a veritable moat of molasses-like consistency, impossible to cross, but the present tableau introduced an entirely new interpretation. Instead of accidentally falling afoul of the viscid glue, the six were dipping first one foot, then the other into the mess, then drawing the strings up and down, first over their front tibia and femur, and next the femora of the middle legs.

The general effect was of slowly stropping a razor, or, non sequitur, a circle of old ladies winding and rewinding hanks of yarn.

Soon, all but one were heavily coated with the gum, and walking about freely, not impeded in the least by the smeared substance which would have entangled and incapacitated any other insect. Their post emergence activities formed an elaborate sequence; the insects hatching and walking about for a time beyond the egg mass; then a return and a long continued dipping into the mucilage, followed by an equally elaborate scraping up of the glue; finally, a vigorous rubbing in on all reachable parts of the limbs. This complex succession of instincts was of course unlearned, and completed within an hour after leaving the egg.

The stickiness of the fore legs of many members of this family is well known to every field naturalist, but it has been variously attributed to resin or secretion from definite glands. The object was confirmed in subsequent experiments when minute insects were entangled in the stickiness and at once impaled on the newly formed beak and sucked dry. I looked up from the Reduviids and found the sun was shining.



ONE DAY when prolonged rain had driven us back to work in the laboratory, we solved the mystery of our bird bath. This is an ornate Victorian affair of cement, holding a perpetually inviting pool, which nevertheless, throughout three seasons, has remained almost unused. An occasional Cowbird or Grackle splashed about but no other birds. Between showers on the day in question a small acacia just beyond the north terrace was alive with birds. At first sight they appeared to be having a general squabble, and then we wondered whether they had cornered a small, marauding Boa Constrictor. Actually, all were engaged in a communal foliage bath, thrashing and fluttering about, sending showers of drops in all directions. There were five species in this public bath — Palm, Blue, Silver-beak and White-shouldered Tanagers and Honeycreepers. On other days we found this habit was a general occurrence with other species, and on three occasions hummingbirds were observed fluttering in midair beneath the avian shower, benefitting from the flying drops. The third time, I saw a tarantula-hawk wasp perched close by and rubbing wings and antennae in the fine mist from the whirring feathers of the hummingbird. This was a triple-play bath; tanagers to hummer to wasp.

EARLY ONE MORNING we heard the cry of a bird which aroused vivid memories (*High Jungle*, Chapter XVI). On the highest dead branch of our tall cedar was a pair of Bat Falcons. Our first reaction was of welcome. Then we noticed the complete silence of the birds in the compound, and with a magnificent leap and swoop, one of the fierce little falcons dropped (I will *not* say "like a plummet"!) and rose again out of the jungle with a hummingbird in its talons. This was more than we could stand, and we began a demonstration calculated to terrify any bird of prey. The falcons greeted our yells and arm-wavings with flattering interest, but not the least timidity. We then went into action with artillery. We had no intention of killing these rare birds so we loaded a revolver with small shot cartridges and fired round after round. This aroused the keenest attention on the part of the birds, but that was all. The same was true of 22 calibre bullets which we sent as near as we dared. The two monkeys, whose cage was directly beneath the hawks' perch, were, by this time, worked up to a frenzy of excitement. I had brought down with me two commercial sling-shots, called WHAM-O by the makers, intended to frighten away stray dogs. We reverted to these medieval weapons with instant results. The fal-

cons watched the first few stones pass by, but when one struck the branch beneath their perch, they fled, screaming.

The only bird which dared to put in an appearance, perching in the very same tree, was a very angry male Cacique, which had flown from his colony of twenty-one nests a hundred yards to the east. Neither bird dared actually to attack, but it was a courageous action on the part of the giant oriole. If allowed to remain undisturbed in the valley the falcons would have decimated our bird fauna. We saw them again, early one evening, justifying their name, as they pursued small bats. Two dives missed, but at the third attempt, neither dodging nor sonar was of avail, and the small mammal was struck squarely. The most recent alarm was caused by a great red-crested woodpecker, looking like our Ivory-bill, which perched on the same dead branch, and gave forth a chattering call which closely resembled that of the falcons.

* * *

For years we have known that many insects can see in ultraviolet light, while red for them is dim or black. It has seemed to European scientists, however, that their swallowtails and white butterflies must be blind to ultraviolet: they apparently not only perceived red clearly, but have a general type of color discrimination very similar to that of human beings. This past month we tested our own black and scarlet swallowtails and the snowy whites of Simla. And there can be no doubt at all of the result: Every one of them responded to pure ultraviolet with all the enthusiastic promptness of red-blind bees and other butterflies, yet, as in Europe, they seemed very partial to red as well. So, perhaps, here we have the spectacle of insects with a truly superhuman spectrum at their command — all the rainbow, and ultraviolet too. However, that seems a hyperbolic gift even for a glamorous tropical butterfly. So until we have the luck to untangle more of the story, this report will have to be continued—in-our-next.



A NEW WORLD FOR MAMBO

Photographs by SAM DUNTON

ALMOST two years ago (on May 22, 1951) we acquired little Mambo, a Lowland Gorilla, with the idea that some day he would take up residence in the Great Apes House with Sumaili, a slightly older Mountain Gorilla. In these past two years Mambo has lived in the Animal Nursery, watched over and played with by Mrs. Helen Martini, until he grew old enough and strong enough to hold his own against the larger animal. On February 18 the transition from Nursery to compartment in the Great Apes House was made easily and smoothly, and Mambo at once took to his new playmate, Keeper Quinn. Introduction to Sumaili, however, has not been so readily accomplished, for she weighs 105 pounds against his 62 and plays more roughly. But in a few weeks, we hope, they will be together all the time.

3 This could have been a disturbing moment, but the little Gorilla showed no fear of the automobile.





ave-taking at the Nursery was a ceremonial oc-
sion. Petey, the Woolly Monkey, stays behind.

t the Great Apes House he was transferred to
rs. Martini, for he has great confidence in her.



2 Mambo clung tightly to Fred Martini
as he was carried out of the Nursery.

5 Mrs. Martini's own confidence rather
dimmed during the cage introduction!





6 Later things began looking brighter, although Mambo still needed to be reassured.



7 Then a stranger appeared and introduced himself by offering a full bottle of milk.



8 Fickle Mambo! He turned to play with the beguiling stranger and Mrs. Martini left.



9 Within half an hour Mambo and Keeper Quinn were fast friends and companions.

Fishes Come in White, Too



These two albino Bullheads and one normally-colored specimen are probably of the same brood.

— But They're Commoner in Captivity Than in the Wild

By JAMES W. ATZ

ONE OF THE GREAT ATTRACTIONS of fishing is the thrill of the unknown. In no other sport is the delicious agony of anticipation more prolonged, for not until the line is in or the net hauled close does the fisherman know what he has caught. Even the most skilled fly caster cannot anticipate just when some hungry trout or bass will break the surface to throw itself upon his lure. Professional fishers are subject to the same excitement. A net filled with the right kind of fish means money in the bank to commercial fishermen; economic considerations thus add piquancy to their expectation. But the scientific collector of fishes probably experiences the greatest joy of anticipation of all. To him each seine-haul or depth-charge *may* reveal the evidence necessary to answer some knotty question or substantiate a pet theory; a species new to the locality

may be brought to light or perhaps one new to science. New species or subspecies do turn up with surprising frequency, especially in the waters of the wilder parts of the world.

Northern New Jersey, however, can hardly be called a "wild part of the world" and the members of the New Jersey Department of Conservation who were making a survey of the fauna of Kemah Lake last August had no faintest expectation of the ichthyological curiosity they were about to discover. Kemah Lake is one of numerous similar bodies of water which were being examined as part of a state-wide fisheries survey. In order to improve fishing conditions and enact proper conservation measures, it is essential to know what resources are on hand, and so samples had to be taken of the fish populations in each lake, pond and stream. Usually the fishes are collected by

seining, but where the water is too deep or sunken trees and boulders make fishing with a net impossible, poison is used. The substance most often employed is rotenone, which seems to have the faculty of paralyzing the respiratory apparatus of almost all cold-blooded creatures while being to all intents and purposes harmless to warm-blooded ones. (This property also makes it an invaluable constituent of insecticides).

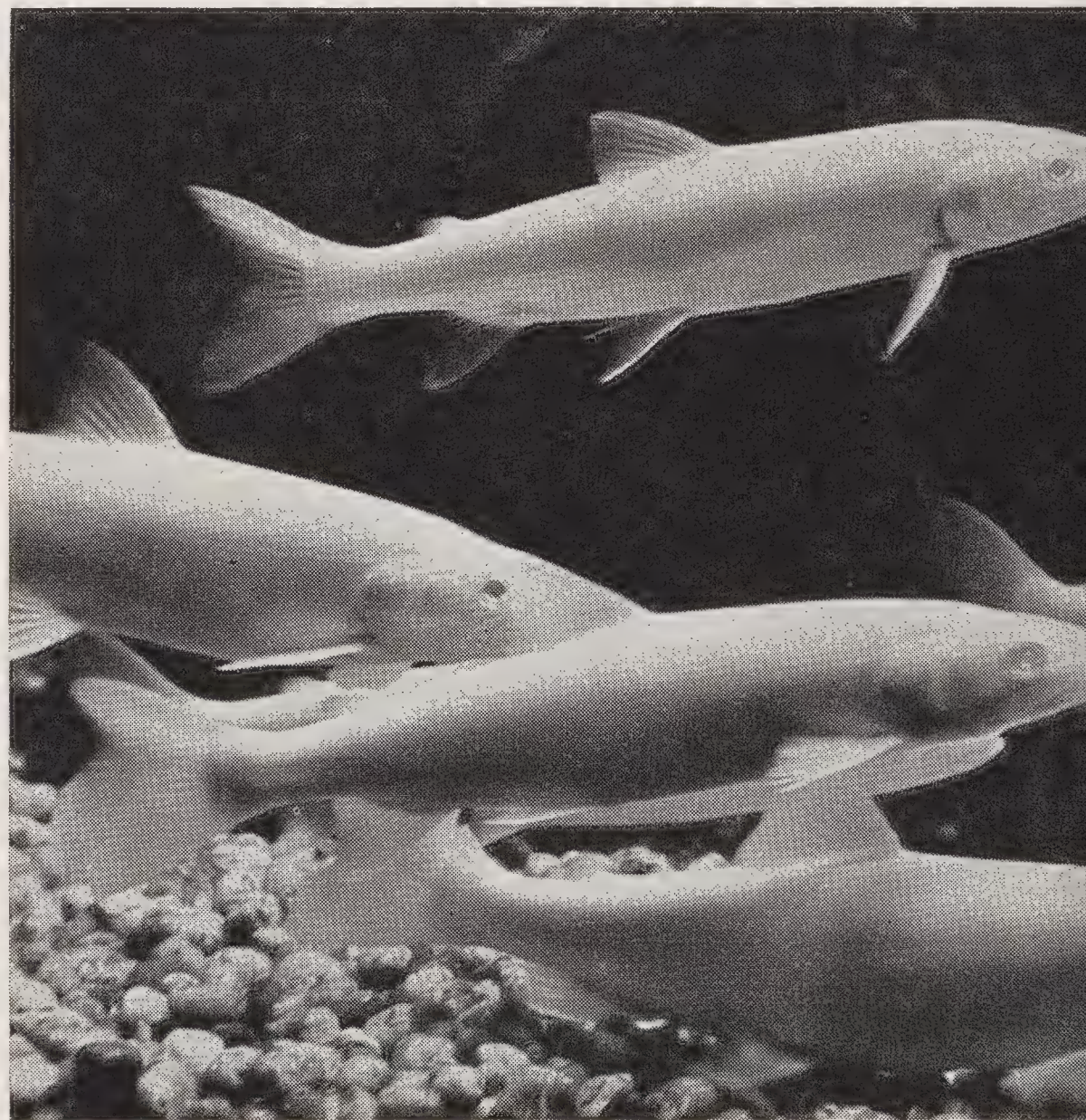
Because one of the coves in Kemah Lake proved inaccessible to seining, the crew from the Conservation Department decided to use rotenone, and the powder was soon mixed in buckets of water and spread out over the surface. One of the good features of rotenone is that it works rapidly. It was not long before sunfish and various minnows appeared on the surface. Among the last species to be affected were the catfish, and as they slowly rose into view there was great excitement — for a whole school of small, *white* individuals had appeared. The vast majority of catfishes are somber-hued; none of those found in temperate fresh waters exhibits any striking coloration. Moreover, there were a number of normal, very dark individuals mixed in with the white ones. All the incapacitated fish were collected and put into bottles of preserving fluid for subsequent careful identification and measurement, but it was immediately apparent that the little white fish belonged to the catfish species *Ameiurus nebulosus*, generally called the Brown Bullhead. They were true albinos, completely lacking dark pigment even in their eyes.

On shore Dr. Alfred H. Schilling, a vacationing dentist, watched the proceedings with interest. About an hour after the rotenone had been applied, he suddenly noticed a small white fish swimming feebly near shore. In its partially poisoned state the young albino was easy to catch, and by walking along the edge of the lake and keeping a sharp lookout, Dr. Schilling was able to spot and collect four more baby catfish, two albinos and two ordinary colored ones. He transferred them into uncontaminated water where they rather quickly revived—thanks to his prompt ministrations and to their own wonderfully tough catfish constitution, which is especially resistant to respiratory stress.

When Dr. Schilling brought his interesting charges to the Aquarium, we learned from him

that natives of the area around Kemah Lake and the Paulinskill, a small stream which drains it, claim that Red Catfish, as they call the pinkish albinos, turn up in those two bodies of water every so often. They are not considered fit to eat, but are said to make especially good bass bait.

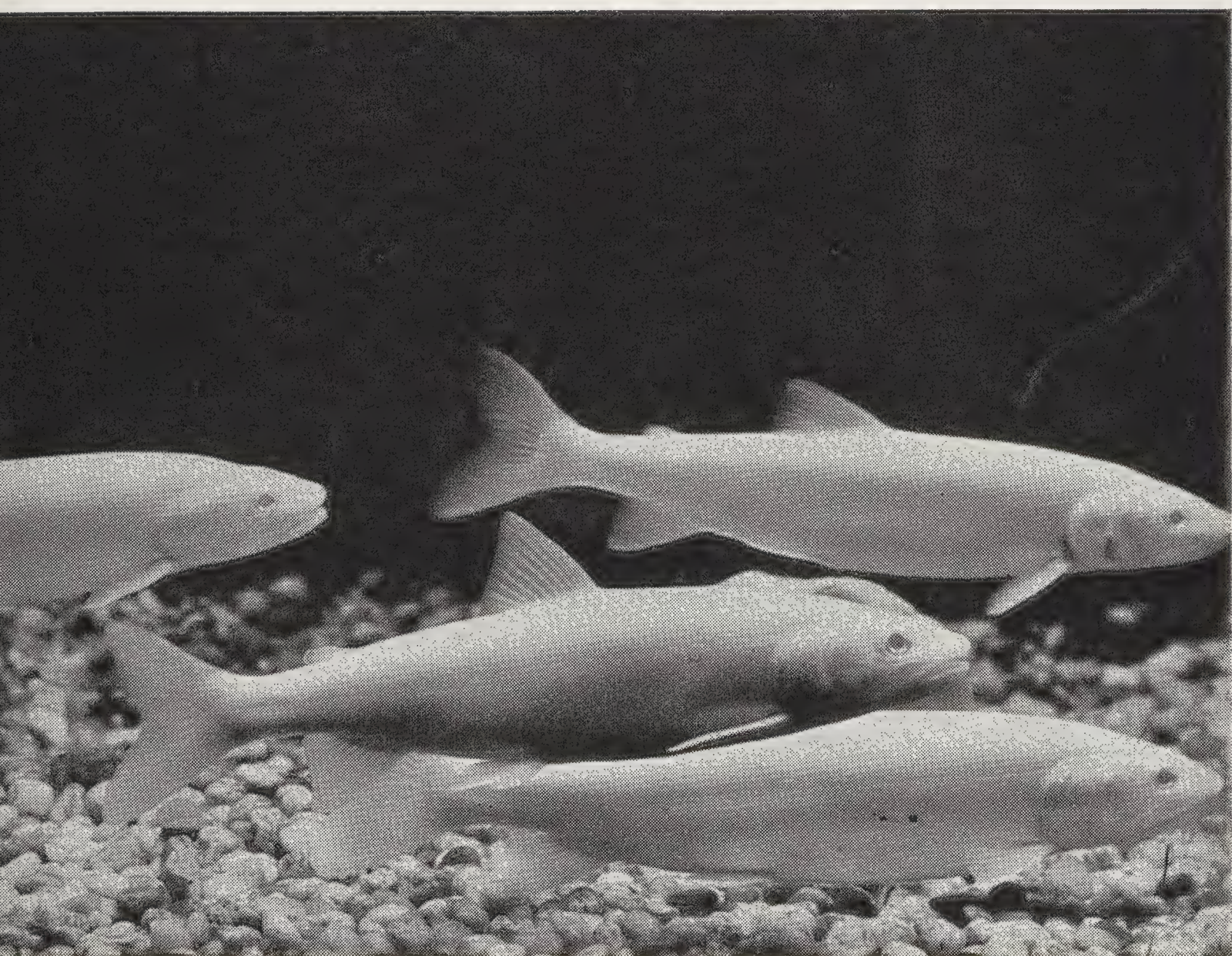
Although we are most pleased with our lovely little albino Bullheads and although they are the first albinos of this species of which we have knowledge, we cannot consider them of epochal importance. Albino fishes are rare but nevertheless have been reported quite a number of times, and among them albino catfishes are especially well represented. For example, more albino specimens of the European catfish, *Silurus glanis*, have probably been recorded than of any other species of feral fish. In Austria they occur frequently enough to warrant a special name, Fürst-



chen, which means princeling. At one time or another albino *Silurus* have been exhibited in most continental aquariums.

Albinism occurs in many different types of animals. Not only are albino fishes, amphibians, reptiles, birds and mammals known, but also albino insects, snails and certain small relatives of crab and lobster. All of these abnormally colored individuals have one thing in common: they completely or almost completely lack dark pigment. Sometimes they show a certain amount of

Albino *Pristellas* are the most recently established strain of home aquarium fishes, imported from Europe only two years ago.



Albino Lake Trout are very rare today. These are from a hatchery strain exhibited for many years in the old Aquarium tanks.

yellow or red pigmentation, and some of them exhibit peculiar grayish “ghost patterns,” but most of them have entirely colorless skin, hair or scales. Our little catfish are of this type. They are completely white except where red blood shows through translucent flesh and gives them a pinkish hue. One of the most dependable criteria of whether a white animal is a true albino or not is the color of its eyes. If these are pink or red — from the rich blood supply of the iris and retina — the creature is undoubtedly a true albino. Our

Bullheads have eyes with a pink iris and red pupil.

It is most interesting that whenever tested, by means of proper breeding experiments, albinism has practically always turned out to be an hereditary defect and usually to be based upon the change (*mutation*, the geneticist calls it) of a single hereditary factor or gene. The evidence for this is really quite simple, even though the theory behind it is somewhat complicated. If two normally colored individuals produce some al-

binos, these will occur in the ratio of approximately one white to three normal. If one of these albinos is bred with either of its parents (*back-crossed*, as the geneticist says), one half of their young will be albinos. If an albino is mated with another albino, all the offspring are albino. When a normally colored individual (not of a strain "throwing" any albinos) and an albino are crossed, all the offspring will be normally colored, but if these are mated to one another, *their* offspring will be one-quarter albino.

These facts have two important consequences. Since albinos "breed true" (except in the few instances where more than one hereditary factor is involved), it is a simple matter to establish an albino strain. On the other hand, because normal-appearing individuals can carry the hereditary factor for albinism, hidden within them so to speak, albinos can crop up every so often in otherwise normal communities, be they of animals or of men.

The number of albinos that appear in a given community or population varies greatly. Among the European races of human beings, for instance, about one out of every ten thousand persons is an albino, while among the San Blas Indians of Darien albinism is seventy times more frequent. And so it is with fishes. In certain places, albinos of a particular species are relatively prevalent, just as albino Bullheads seem to be in Kemah Lake and the Paulinskill. In the Pamunkey River of Virginia, several hundred albino Channel Catfish, *Ictalurus punctatus*, have been caught.¹ Albino Climbing Perch, *Anabas testudineus*, are fairly frequent in Lake Buluan in the Philippines.² In 1938 the Aquarium exhibited three albino clariid catfishes which were said to come from a certain body of water in India where they are quite abundant.

Such high frequencies of albinism among fishes are rare, of course. The reason for this is not hard to find. Because albinos lack protective coloration, they stand out like the proverbial sore thumb and few there are that survive the attacks of the hosts of sharp-eyed predators. It is significant that according to the fishermen around Kemah Lake, albino Bullheads make especially good bass bait. It is also noteworthy that the majority of albino fishes that have been seen in the wild have be-

longed to species of a retiring nature, spending most of the daylight hours under cover and moving about and feeding only at night. This kind of behavior is characteristic of the catfishes. Other secretive species in which albinos have been seen in the wild are the two common edible Eels of Europe and America, and the Wrymouth and various flatfishes such as the Haddock, Dab and Sole. Possible exceptions are the albino Bowfins, Shortnose Gar and Carp that have been found, but these species characteristically frequent sheltered, weedy places.

The few albino trout and salmon that have been caught in nature do not fit so well into this picture. Albino trout are among the best known of all albino fishes, but this is because of their occurrence in fish hatcheries. From time to time fish culturists have taken the albino trout that occasionally hatch out in their troughs and have maintained them separately, eventually breeding them to each other and thus establishing albino strains. The Fisheries Research Laboratory of Pennsylvania at present has such a strain of albino Brook Trout. Albinism has also appeared in the Smallmouth Bass maintained at the State Fish Hatchery at Tionesta, Pennsylvania.

It is obvious that albino fish stand a better chance of surviving in captivity, where they are protected and even selectively bred. Among the fishes kept in home aquaria, quite a few albinos have been seen, and because of both their novelty and beauty, a few of these have become established as special varieties, more or less regularly available on the market. Among these are albino Paradise Fish, Swordtails, Mollys, Guppies and Pristellas. Albino Barbs and Siamese Fighting Fish have been reported, but have never become established as aquarium fish.

The real importance of these albino fishes, however, lies not in their strangeness or loveliness, but in their usefulness to the scientific investigator. Through the study of these fish, which lack pigmentation, has come about a better understanding of how pigment is formed in normal individuals and what factors influence the special cells that manufacture and store the colored stuff. Some of the essential steps in the appearance of pigmented patterns were unknown until their absence was discovered to be the cause of albinism in a particular kind of fish. Moreover, since

¹ Menzel, *Copeia*, 1944: 124.

² Herre, *Philippine Jour. Sci.*, 24:683-707, 1924.



A special strain of Albino Swordtails has been developed for cancer research. The upper fish is normally colored, with a melanotic tumor. The albino below has the same tumor but colorless.

albinism is the result of a change in a single hereditary factor or gene, much can be learned about the functioning of these fundamental units of life by seeing what happens when they fail to perform their normal duties.

Perhaps the most spectacular use to which albino fish have been put is in the breeding experiments carried on by Dr. Myron Gordon, the Aquarium's Geneticist, in the Society's Genetics Laboratory. There Dr. Gordon has been investigating the pigmented tumors called melanomas, that appear in certain hybrids between Platyfish and Swordtails, both of which are popular fishes with home aquarists. These cancerous growths were always associated with a superabundance of black pigment cells; in fact, if a hybrid did not have a certain kind of black pigment cell it would never develop melanoma. Inevitably the question arose as to what part the pigment itself played in tumor formation.

In order to clarify this important point, Dr.

Gordon used albino Swordtails as one of the parents in his crosses. The other parent was a black-spotted Platyfish. As was expected, none of the hybrid offspring were albinistic. Some of them, showing abnormal black growths, were again crossed with an albino Swordtail. According to the laws of heredity, one half of the offspring of this backcross should have been albino. But also, according to the same laws, one half of them should eventually show melanomas. The crux of the matter was whether any of the fish lacking pigment would nevertheless have tumors. Some of them did. These peculiar fish suffered from what might paradoxically be thought of as pigmentless, pigmented tumors. Technically, their abnormal growths are known as *amelanotic melanomas*.³ They are no less deadly than black melanomas, and just as human beings suffer from ordinary black melanomas, so are they sometimes afflicted with amelanotic ones. Dr. Gordon is thus able to produce at will in his fishes the counterpart of a rare but deadly human affliction.

Albino fishes, which were once considered simply as freaks of nature, now have become valuable tools in biological and medical research.

³ Gordon, "The Biology of Melanomas," pp. 216-268, 1948.

ADVENTURES WITH A TAIPAN

By DAVID FLEAY

Director of the Fauna Reserve at West Burleigh, Queensland, Australia

IN THE WINTER OF 1950, newspapers in Australia carried the story of a young Sydney snake collector named Kevin Budden who had been bitten by a Taipan he had caught in the scrub country near Cairns in Queensland. Next day there was a further story; Kevin Budden had died, yet another victim of Australia's deadliest snake. Although he was an expert in the handling of snakes, he had not been fast enough to master the Taipan and his situation had been hopeless despite every preventive measure and the injection of Tiger Snake antivenin.

Kevin Budden had not gone after a Taipan from idle curiosity. Even after being bitten he had hung on to his captive, pushing this last snake he was ever to capture into a bag and asking that it be sent to the Commonwealth Serum Laboratories in Melbourne for investigation of its venom.

In our Healesville home we read these sad facts, heard them re-

peated over the radio, and regretted with everyone else that so promising a student had lost his life. But we suspected no link with our own lives.

Then on the evening of July 31, three days after the accident, the telephone rang at home, and the voice that came over the wires had a startling request to make. It was Dr. F. G.



The Mulga or King Brown is a snake often confused with the Taipan, but the latter is far more to be feared.

(David Fleay Photo)

"milking" of the Taipan must be finished and Fleay grips the writhing snake before dropping the collecting bag.

(David Fleay Photo)



Morgan, director of the Commonwealth Serum Laboratories at Royal Park, asking whether I would be prepared to handle the Budden Taipan for "milking" purposes. The snake was by that time already in the Melbourne Museum, having been sent by air freight the 2,000 miles from Cairns.

In former years Dr. Morgan and I had worked together with snakes many times, and I knew he would not make such a request lightly. But I also knew the Taipan very well, by reputation, even though I had never seen one in the field, much less handled one.

I told Dr. Morgan that I would think it over and give him my decision the next day.

The night did not pass at all quickly. I kept thinking that only a few days before a young, alert, expert snake-catcher had been killed by this very reptile and that I had had no experience with Taipans whatsoever. There was no known effective antidote to Taipan venom — that was something else to remember.

But, again, one had to remember the lad who lost his life capturing this snake, and his own courage in disregarding the bite long enough to make sure it was sent to the laboratories for serum investigations. He had hoped — and so must everyone who had anything to do with this job — that this might be the start of research that would eventually lead to effective treatment.

I rang Dr. Morgan in the morning to say that Roy Goodisson and I would come right down by automobile and go through with the job of han-

dling the snake, for better or worse, that afternoon.

Arrival at the Melbourne Museum meant evasion of reporters and photographers, for the Taipan affair and the proposed extraction of the snake's venom had become headline news. There was none of the air of calmness about the proceeding that might have served to steady the nerves. In the preparators' room at the top of the Museum — where, to my dismay, the radiators were going full blast and the room was at summer heat, meaning that the snake would be warm and active — I found the air freight box standing where the porters had dropped it on its arrival from Cairns. Nobody had touched it or looked inside.

It was a gauze-wire-covered box and through the wire I could see a tightly knotted hessian bag. We were told that there was another bag inside this one, and the snake in the inner bag.

Dr. Morgan brought out his rubber-topped jars into which the venom was to be expressed. Then, very quietly, he placed within reach a pair of scissors, several lengths of rubber ligatures and some thin-bladed scalpels. Nobody commented on these accessories, but we knew very well what they were for!

Well, everything was ready. I ripped the wire off the box, drew out the heavy bag and cut the string, up-ending the bag to get at the inner bag. Instead, the Taipan fell out, threshing and gyrating. The inner bag was there, all right, but sometime during the transit the snake had escaped from it.

And what a beauty it was! Six feet five inches

long, in the finest possible condition, its orange-red eyes glittering, the white upper lip emphasizing the mouth, and only a few scales missing from the middle of the back—a superficial blemish probably sustained at the time of its capture. And just as I feared, the heat of the room had put it in a most active and dangerous state. Its copper-brown body looped menacingly and it struck repeatedly to right and left.

I studied the snake for a moment, sizing it up, watching its tactics. The time for action had come and all my trepidation vanished, for this was, after all, just another snake to be seized, held firmly, and “milked” of its venom. I hooked at it with the snake-stick and pinned it down while the thick body lashed and writhed in furious protest. A necessarily lightning-quick motion on my part and I managed to grasp it with thumb and bent index finger just at the base of the head.

I lifted the Taipan to table level; Dr. Morgan brought up the first rubber-topped, drum-like collecting bottle, and like a suddenly-sprung rat trap the snake plunged its fangs into the rubber and chewed viciously. From my position above the vial I could not see the venom dribbling down, but I knew it was there, for this was a

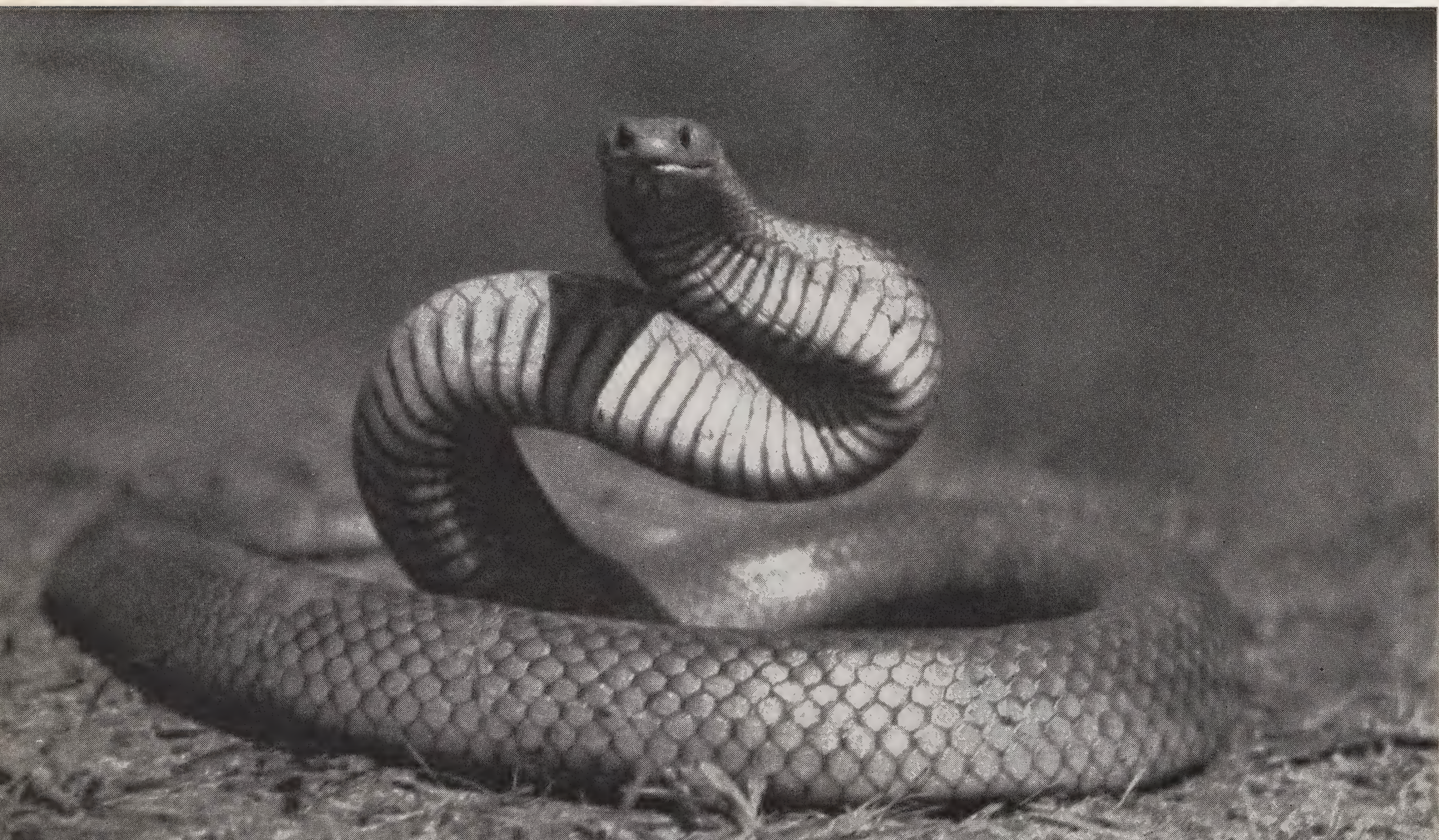
perfect bite. Knowing the risk he ran, Dr. Morgan expressed the snake’s reserve of venom by pressure and massage on the area behind the eyes where the venom glands are located. I held on grimly while the tail and lower body of the snake bumped against me, finally winding tightly about my right leg. Mr. Goodisson thoughtfully unwrapped the reptile.

A moment later the rubber top of the vial burst and Dr. Morgan brought up a second one. Again the Taipan chewed long and savagely. About half a teaspoonful (78 milligrams of dehydrated venom it later made) of pale whitish venom had been collected in the two vials. This we considered a remarkably good collection, considering that the snake had bitten Kevin Budden only four or five days before and that this was not a really large Taipan. The average Tiger Snake, for instance, yields only about 34 milligrams of venom at a time. I was interested to note, while the snake was chewing, that the Taipan’s fangs are comparatively enormous—far larger than those of the largest Tiger Snake.

The intensity of my grip was now giving rise to muscular cramp, a sure sign that it was time to return the snake without delay to a secure container. A stout bag had been suspended alongside the wall and I pressed the snake’s body flat to the wall, gradually lowering it tail-first into the bag. The last step was to dash the head end downward into the bag after almost all the body

All brown-colored snakes in Australia are fast and usually aggressive when cornered. The Common Brown Snake is one of the most widely-distributed species, also one of the most dangerous kinds.

(David Fleay Photo)



was inside. This seemed simple and safe, but so stiff, resistant and muscular was the Taipan's body that my last vigorous thrusting of the head and neck carried it downward only six inches below the top of the bag. But before it could poise for a strike the wire loop at the lip of the bag was twitched shut, and the job was done.

Dr. Morgan, Roy Goodisson and I all agreed that we had just dealt with the most savage, tough and insistent snake in our joint experience — which was considerable.

The results of Dr. Morgan's work with the venom are not yet to hand. It does not, of course, embrace the manufacture of antivenin, for a great deal of venom, from many Taipans, would be necessary for that. But the Cairns Taipan furnished enough for preliminary experimental work on the analysis of the venom, and also on what degree of protection might be offered by Tiger Snake antivenin.

TAIPAN is a native name, given by the aborigines of Cape York Peninsula and generally used in Australia. *Oxyuranus scutellatus* is the scientific name. But whatever the name, it is a snake that is feared intensely not only by the aborigines but by the whites. It is comparatively rare, attains a length of ten to eleven feet and may be as thick as a man's arm. Actually it may grow to even larger size, for there are very few specimens in museums for comparison, and the fact that the species has been recognized as the representative of a distinct genus only since 1923 emphasizes the little that has been known about it.

The Cape York natives report that it lives in rat burrows among the bladey grass. Its fangs are almost half an inch long and in a bite it injects at least twice the amount of venom produced by any other Australian colubrine in a primary yield.

Few snakes are quicker in their reactions and movements, and it has been asserted by the few persons who have had experience with it — notably Dr. Donald Thomson, who spent some years on Cape York — that it will attack without provocation. One ominous fact is that no victim really bitten by the Taipan — and there have been at least four — has had any chance of recovery. Dr. Thomson noted that a Taipan in North

Queensland killed a horse in five minutes and that one of his dogs was bitten and succumbed shortly thereafter, showing on subsequent examination the most intense congestion in every organ. *Oxyuranus* venom is powerfully neurotoxic. Because the snake is little known (apart from legend), is rarely seen and is still more rarely collected in its native Queensland, no antivenin has ever been made and the Commonwealth Serum Laboratories had had no venom to work on even experimentally until the Cairns Taipan came along.

It now appears that the Taipan is more widely distributed than was previously thought. Mr. George Mack, Director of the Queensland Museum, has an *Oxyuranus* that was killed a year ago at Gympie, only a hundred miles north of Brisbane and more than a thousand miles south of the Cape York Peninsula. It is an undoubted Taipan, and the known range of the snake is thereby greatly enlarged.

There are, of course, many so-called Taipan discoveries, resulting in large, fearsome-looking and usually very battered brown snakes being sent to museums and zoos. Usually on examination they turn out to be Mulga Snakes (*Pseudochis australis*). Aborigines in the north are apparently well aware of the difference between this species and the slender-necked and far more potent Taipan, even if they do not know how to make scale counts or even know that the Taipan's neck scales are narrow, elongated and bluntly keeled. But the Mulga or King Brown Snake is coppery-brown to reddish-brown in color and it inhabits roughly the same territory as the Taipan, so it is understandable why it is so often confused with the latter.

The true Taipan is so rare that comparatively few naturalists have seen it in the wild. I have never seen it in the bush myself, but some day I may, for in the past year I find myself living in warm, sunny Queensland, at West Burleigh, only 130 miles south of Gympie where the Queensland Museum's specimen came from. Interesting possibilities lie ahead for field studies. And if I see a Taipan in the field, I am sure I will not confuse it with a Mulga, or any other reptile. I'll recognize it, all right!

News from the Conservation Foundation

"Forests for the Future" Is Ready for Distribution

The Conservation Foundation's two-year survey of the forest situation in the United States was completed last fall and the report based on its findings was published as a supplement to the December issue of *American Forests*, the magazine of the American Forestry Association, under the title of "Forests for the Future." With certain revisions this report has been reprinted and is now available to Society members who may wish to see this latest version of our findings in a most important field. This reprint may be had by writing to the Conservation Foundation, 30 East 40th Street, New York 16. The edition is limited, so it must be a case of "first come —."

Animal Population Study To Be Sponsored

At the suggestion of Dr. Evelyn Hutchinson of Yale University and Dr. Caryl Haskins of the Haskins Laboratories, both members of our Scientific Advisory Council, the work of Mr. Lawrence Slobodkin has been studied with a view to giving it joint sponsorship by the Foundation and the Zoological Society. Mr. Slobodkin's proposal is for a limited grant to enable him to complete a mathematical study of animal population change, employing techniques not hitherto applied in this field.

Columbia University Press May Publish Pamphlets

The pamphlet form of publication is most appropriate for the printing of a number of the Foundation's projects reports, but pamphlets, for a number of reasons, offer both printing and distribution difficulties. After a wide and long study of possible approaches, the Columbia University Press appears to offer the best solution to this

problem. The Press is now working out a proposal which will be equitable from its standpoint and the Foundation's.

The Columbia University Press is able to provide wide distribution to teachers, schools and technicians, and also has storage and shipping facilities.

Yale to Continue Courses In Conservation

Yale University has undertaken to continue its Conservation Department for the next two years, supplying support from University funds.

For the past three years these courses, under the direction of Dr. Paul Sears, have been made possible by funds made available through the Conservation Foundation. An anonymous donor has given funds for a two-year scholarship program in support of the Yale courses.

Plans are being made at Yale to offer special training for watershed managers, who will need indoctrination in forestry, biology, engineering, meteorology and soils. Because of the scope of such studies, consideration is being given to the desirability of establishing prerequisite professional administration or field experience in connection with watershed work.

Washington Conference Panels Are in Preparation

The Washington Conference on resource needs in the United States, to be held sometime in the fall of 1953, will be based on a series of panels, each to cover one field of resource requirements. In collaboration with Resources for the Future, Inc., the subsidiary organization set up by the Ford Foundation, staff members of the Conservation Foundation are preparing outlines for panels on public awareness and research. Mr. Osborn is a member of the Board of Resources for the Future, Inc.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Children's Zoo Will Re-open Saturday Before Easter

Whatever the calendar or the weather, spring begins officially in the Zoological Park when the Children's Zoo opens. This year it will be on Saturday, April 4, the day before Easter.

The Farm-in-the-Zoo is also scheduled to re-open on that date, but actual opening depends on completion of a new access road for tractor trains which may delay the event a few days. The inauguration of the new Bronxdale Parking Field also depends on the access road.

Tractor trains resumed operation on March 27. The Platypusary will re-open late in April or in early May, depending upon the arrival of really warm weather. This year for the first time we plan to exhibit Cecil and Penelope, the two Duck-billed Platypuses, for an hour each, thus keeping the Platypusary open from 2 to 4 o'clock each day instead of only one hour, as heretofore.

The Peaceful End of "Pete"

"Peter the Great," better known as "Pete," our Hippopotamus, was painlessly destroyed on Sunday, February 1, after the infirmities of old age finally caught up with him. He was 49 years, 5 months and 19 days old, having been born on July 13, 1903.

His passing occasioned newspaper articles and editorials, and brought a nostalgic letter from an elderly woman living in Portland, Maine, who recalled that she had seen Pete for the first time when he was only five days old, and that she had visited him every year except two since 1916.

Pete held the world's record for Hippopotamus longevity, the next best being that of Betsy II in the Amsterdam Zoo, which lived for 41 years, 9 months and 10 days. Betsy II had been estimated to be about 18 months old when she came to the Amsterdam Zoo, giving her an estimated life span of about 43½ years against Pete's known age of about 49½ years.

Pete's old home in the Elephant House is temporarily vacant, pending redesigning. Later we hope to acquire a pair of young Hippopotamuses.

Redesigning the Reptile House

The Reptile House has been closed for complete redesigning of its interior and will be re-opened, we hope, by early fall. Plans for spectacular new exhibits have been drawn under the direction of Curator Oliver. The building — the second one in the Park, opened in 1900 — was given a new roof this past winter.

Our Okapi Held the Record for Longevity

In the September-October issue of *ANIMAL KINGDOM*, in reporting the death of our first Okapi, we said that a specimen in the Rotterdam Zoo held the longevity record, with more than 16 years. This was a double error, for the animal in question had lived in the Antwerp Zoo, and it now turns out that our Okapi lived about three weeks longer than the Antwerp specimen.

In correspondence with General Curator Emeritus Crandall, Director Walter Van den bergh of the Antwerp Zoo reports that their Okapi, a female, came on September 15, 1928, and died on September 25, 1943, giving it a longevity of 15 years and 10 days.

Our male came on August 3, 1937, and was destroyed, because of advanced arthritis, on September 5, 1952, thereby establishing a longevity record of 15 years 1 month and 2 days. These records still, of course, leave open the question of the potential longevity of an Okapi. The Antwerp specimen died during the war, when food was hard to get and the animals in the Antwerp Zoo were on short and unsatisfactory rations, and our animal had to be destroyed. There are, however, Okapis in several European Zoos and we still have a specimen, so that further records will certainly be forthcoming.



We know little about the early history of the two young Lesser Pandas that arrived in early March from Calcutta, except that they must have been accustomed to people, for they are quite tame. Here Dr. Gandal offers them their first meal of bamboo in their new home in the Zoo.

The Death of Herbert

We regret to announce that on March 17, Herbert, our baby Walrus, died of an intestinal obstruction caused by a rubber ball thrown into his pool by a visitor. Just about two years old, and in the Zoo since October 18, 1951, Herbert weighed 958 pounds. He was the only Walrus in the United States. We hope to obtain another next fall.

Miscellaneous Notes

A rather rare snake, *Dipsas andiana*, which feeds on snails and slugs, recently arrived on a banana boat out of Colombia and has been given to the Reptile Department. It has eaten several snails and Dr. Oliver is attempting to get a photographic record of its peculiar method of feeding.

The Zoological Society is continuing for 1953 its own "Point Four" program of aid to European biologists, which was inaugurated last year with considerable success.

Dr. Myron Gordon has been asked by the University of North Carolina to advise it about the

maintenance of its experimental colony of Platyfishes.

Assistant Curator Atz of the Aquarium spoke on "Orientation in Schooling Fishes" at a conference in Washington on orientation in animals. The meeting was sponsored by the Office of Naval Research.

Our Heads and Horns Collection Still Has Many Records By JOHN TEE-VAN

The National Collection of Heads and Horns, housed in the Heads and Horns Museum on Baird Court in the Zoological Park, contains a most comprehensive mounted collection of the antlered and horned animals of the world. The building and its collections, made possible through generous gifts of many friends of the Society, was opened in 1922. At that time Dr. William T. Hornaday, the Zoological Park's first Director and the founder and organizer of the heads and horns collection, drew attention to the world's record heads in the museum by marking them

with a conspicuous blue star; red stars marked the second world's record heads. The number of trophies thus indicated was amazingly large.

For years methods of measuring antlers and horns and determining what constitutes a record have been the subject of earnest discussion, culminating — as far as North America is concerned — in the recent publication by the Boone and Crockett Club of modern standards for North American animals. These new standards give greater credit to normally developed antlers and horns and penalize freak developments, some of which had been considered world's records in the past.

Using the new official system, all of the North American heads in the National Museum were remeasured in 1952 by Mr. Samuel Webb, Mr. Grancel Fitz and Mr. Milford Baker, and their findings recorded in "Records of North American Big Game," edited by Webb, Baker, Barbour, Ely and Gilbert, published by Charles Scribner's Sons, 1952; pp. xiii, 1-178. The results of the remeasurement are exceedingly gratifying.

Among the 22 groups of antlered or horned

animals listed in the Boone and Crockett Club's recording, the National Collection contains 70 heads out of 683 recorded. We have six first world records, five second records, two third records, three fourth records and two fifth places. In the non-antlered or non-horned group, we have the second world's record Alaskan Brown Bear skull and the first and second world's record tusks of the Pacific Walrus. The pre-eminence of the Heads and Horns Collection is thus newly and amply demonstrated, even without considering animals from continents other than North America.

Zoological Society members, especially sportsmen, will be much interested in this new volume by the Committee on Records of the Boone and Crockett Club. It explains graphically how antlers and heads should be measured and how they should be cared for, both in the field and in the museum.

In the near future the Heads and Horns Collection will be reorganized and renovated, duplicate heads will be removed, and the entire building interior provided with up-to-date decor.



In the November-December "Animal Kingdom," Mr. McClung reported the birth — the first, apparently, in any zoological park in this country — of a Uele Colobus baby. Mother and baby (Left) are still doing well and the baby is beginning to show adult markings. Now (Right) we have an Angola Colobus baby, too, born on January 30. A first offspring was born to this mother last year but it did not long survive. The present baby seems to be in excellent health.

PUBLICATIONS OF INTEREST

ROBINS IN THE GARDEN. By Olive L. Earle. Illustrations by the author. 64 pp. Morrow Junior Books: William Morrow & Co., New York, 1953. \$2.00.

Certainly March to November marks the season of greatest interest in the life of a Robin, and Miss Earle has recounted the conventional series of events in a manner that will appeal to young children. There are adventures enough but always there is a happy ending — even a predatory cat is foiled at the last moment. Here and there a drawing leaves something to be desired but most are excellently done. This little book contains much that will interest a child and nothing that will shock or offend him. — L.S.C.

ALLIGATORS AND CROCODILES. By Herbert S. Zim. 63 pp., numerous illustrations by James Gordon Irving. William Morrow and Company, New York. \$2.00.

This is another praiseworthy product of the team of Zim and Irving in the series of Morrow Junior Books on science subjects. Like the earlier books in the sequence, this one is admirably illustrated and includes a large amount of interesting factual information for the young reader. Because of the wide audience these books enjoy and the commendable educational service they perform, it is unfortunate to note several inaccuracies in the contents of the book. The most serious of these is found on page 38 in the long-held, oft-stated but erroneous idea that a reptile's body temperature corresponds to that of the surrounding air. Recent investigations reveal the

fallacy in this idea and show that the reptile's body temperature frequently has little relation to air temperature. In fact, the body temperature of the reptile may be more than ten degrees higher than that of the surrounding air. — J. A. O.

SHORELANDS SUMMER DIARY. By C. F. Tunnicliffe. Illustrations by the author, 16 in color, 186 in black and white. Pp. 160. Macmillan & Co., N. Y., 1952. \$8.00.

"Shorelands Summer Diary" might have been called "Summer With the Birds of Wales," for that is what it is. But so prosaic a title would have been no indication of the high literary and artistic level of this beautiful volume. For here is a book that must be described with restraint. No need here for the barbed half-truth, the veiled touch of sarcasm, but rather for a curb on enthusiasm.

"Shorelands" is the newly occupied home of the author, on the island of Anglesey, barely separated from the northwestern coast of Wales. Quaint settings and local events are described with intimate charm but brief accounts of horse shows and dog races invariably turn into delightful accounts of birds seen or heard.

In the color plates, Mr. Tunnicliffe's skill is seen at its best. Drawn with impeccable accuracy, there is a softness of plumage, a roundness of body and a trueness of foreshortened line, that will satisfy the most exacting. The latter point is well exemplified in the illustration of fighting Sheldrakes, a most difficult subject.

The black and whites, mostly done in the scratch-board technique in which Mr. Tunnicliffe is so completely at home, are admirable.

Altogether this is a truly lovely book. — L. S. C.

New Members of the New York Zoological Society

(Between January 1 and February 28, 1953)

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Wouldn't Your Club Like an Expedition Zoo?

So many clubs, societies and other organizations have been enjoying the Zoo's hospitality, we wonder if others of our members would not like to lead a safari to the Park this spring.

We like to play host at the Park.

For ten years now the University Club has come here for lunch and a trip among the animals — over 300 strong last year with plenty of grandchildren and boys and girls "borrowed" for the occasion. The New York State Chamber of Commerce, the Coffee House Club, the Vassar Club of New York and the Garden Club of America are among the organizations which have given us the pleasure of entertaining them.

It occurs to us that there are probably many other Society members who would like to bring *their* favorite clubs here for a day with nature. Parent-Teachers Associations, for instance. There must be many, many organizations that would enjoy an unusual party in the open air, a moderately-priced and delicious lunch outdoors, and lots of fun. There are many services we can offer — many ways in which you can make such an expedition of benefit to your club.

Since each such party must in its way be hand-tailored to the needs of the organization, we suggest that you have your organization's program chairman write us, telling the name and size of the organization and how many he thinks might like to make the trip. Perhaps an idea of what he thinks the membership would be interested in, and approximately what price per head he thinks they might be willing to pay. Then we could confer with him on the details. Write to:

GORDON CUYLER,
New York Zoological Park,
Bronx 60, New York
(FOrdham 7-2000)

P.S. — These parties are scheduled for week-days only. The Park is too crowded on week-ends to do a proper job, and you wouldn't have the place so much to yourselves.



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ANIMAL KINGDOM

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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The Weather and the Zoo

IT IS A generally accepted fact that weather is the most common topic of casual conversation. To the majority of city dwellers, however, it does not make a lot of difference whether it is a "rain" or "shine" day, at least during the week. Farmers presumably have the most direct stake in weather conditions. The members of our organization will probably claim they are just as weather-conscious as any farmer. Public attendance at the Zoo reflects weather conditions almost exactly. A rainy week-end is a pretty gloomy affair for everybody, but particularly so at our Zoo. Average week-end attendance, if the weather is fair, runs to 60,000 or more visitors. If it is rainy only one-tenth of that number will come. During the spring last year, there were seven rainy week-ends out of nine and our attendance for the year never could catch up after that abominable spell. One shivers to think what might happen if, through a concatenation of conditions, every week-end were rainy through the spring and summer season. Fortunately, as we all know, weather averages out about the same over the years. If we had our way, it would only rain between sun-down and sun-up. That would be the millenium as far as running the Zoo is concerned.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

SOCIAL GRACES IN ELK SOCIETY

By MARGARET ALTMANN

Department of Agriculture, Hampton Institute



EVERYBODY SWAPS STORIES about Jackson Hole Elk at hunting time, and of the hard winter when the Elk come into the valley for handouts of hay, but few stories have been reported on their activities during the time when they raise their young and live proudly all by themselves in the mountain meadows of the summer ranges. Such a story I am going to tell.

From the headquarters of the Jackson Hole Research Station of the New York Zoological Society at Moran, Wyoming, I set out to live for a number of months with the herd of Elk (or Wapiti) of the Jackson Hole region. The feel of their social lives could not be gotten on the "easy installment plan" by just sneaking up on them

for a morning or evening hour, or a few days. A pack mule and a sure-footed horse were needed, and one had to "wapitize" one's whole existence: time-schedule, food, clothes and even one's way of breathing. I had to follow the yearly migration of this big herd of Elk which leads many miles from the pulse of the highway over trails rising and winding up to the 10,000-foot level. I had to cross streams even when they were high with spring-snow water, and to make my way through swamps and around quicksand.

Although 10,000 or more Elk are involved in the migration of the Jackson Hole herd, I found that they migrate most often in small groups of five to thirty animals. While on their way,

but still in the lower meadows, the pregnant cows pause for a few weeks to await the birth of their new calves. They usually choose beautiful, wind-protected slopes which are exposed to the sunshine and are traversed by small, clear streams. As the group of bachelor males impatiently marches on to higher grounds, the nursery herd is formed by the Elk cows and their new calves, and by last year's calves, now yearlings.

A mature Elk cow is always the leader of such a nursery group. Her decisions on direction and

time of group movement are accepted by all the others in her band. It was surprising to me to see how this discipline functions, mostly without any apparent opposition or acts of violence. Sheer prestige seems to do the trick. Even the notoriously unruly Elk teen-agers (yearlings) of both sexes yield to the lead cow.

There are plenty of tensions and conflict situations in an Elk group at spring time. The birth of the new calf dislodges last year's young Elk from the affection of the mother, and his jealousy is apparent. But the Elk cow drives the yearling away to a marginal distance. It is still a member of the group, but it must keep at a safe distance from the new calf and the nursing mother. Whenever the yearling comes too close, the cow dashes forward to chase it back. Very rarely does she have to strike him with her front feet. The yearlings respect her gesture and discipline is very apparent.

The new-born calf is hidden by its mother for about three weeks until it is able to keep up with the grazing group. The Elk cows are very ingenious in selecting a place for the calf — a place to which they can return and watch and nurse the calf every few hours. As the calf matures, these nursing intervals become more infrequent. At this time I discovered the existence of calf pools; that is, a place where several calves, five to eight or more, were hidden jointly. Carefully watching such a calf deposit, I noticed that one mature cow was grazing nearby and watching the little calves, almost like a kindergarten



Elk on the move are an imposing sight, and one that requires elk-like stamina on the part of an observer.

(James R. Simon Photo)

The author found that telescopic observation was often the most practical way of observing Elk behavior.

(Highley Photo: Reprinted by permission of the Saturday Evening Post)





teacher. After a while one, and soon two or three, of the calves got up and staggered around playfully, sniffing and nosing each other; but when the Elk cow approached they quickly flopped down and took up their motionless hiding position as if they had never left it. At this early age, the calf is very trusting and affectionate. It follows anybody, a human being, a horse or a cow, even if one tries to shoo it back.

One day while watching a nursery herd, I heard a calf cry and call loudly and urgently for help. A wave of emotion went through the Elk cow group. All other activities stopped and everyone started searching for the calf, which had fallen in a ditch hidden by willow-thickets. As soon as its mother had found and recognized the calf by getting its scent, the other cows returned quietly to graze. The cow nudged and pushed the calf gently to a shallow place in the bank of the ditch and it climbed out.

Deeper and longer-lasting disturbances occur when enemies show up. For instance, a Coyote may appear in the meadow near the nursery herd. One day I saw an Elk cow leave the herd and dash vigorously uphill in pursuit of a fleeing Coyote. As she caught up with him, she stamped

Fawns in a nursery herd lie very quietly as long as they are under observation by the cow, but are inclined to play when the attention of their guard is removed.

(James R. Simon Photo)

Trailing the migrating elk into their high summer pastures means weeks on horseback in the lonely and beautiful Jackson Hole country of Wyoming.

(Keighley Photo: Reprinted by permission of the Saturday Evening Post)

and bounced her front feet while the Coyote tried to hide in a rock-pile. Sniffing and searching, the Elk succeeded in finding the Coyote, and pursued him farther in swift runs. I stood breathless, watching the pursuit; after half an hour, the badly beaten, howling Coyote escaped, and the Elk cow stood for a considerable time on the crest of the ridge on the lookout for his return. Then she slowly walked back to her herd and resumed grazing. Although the many hours of idyllic life with the calves in the stream-bordered meadows and slopes look like a vacation for the cows, they are, however, not devoid of purpose-

ful activities. The Elk mothers take their calves down to the streams as soon as they are two weeks old and can wobble along for short distances. Here the mothers teach them to get acquainted with water; first they splash in a shallow side arm of the river protected from the swift current. Elk calves have to learn that water is fun.

from the danger of being swept away by the Elk cows swimming in the current downstream. Reaching the opposite bank, the Elk shake themselves and march on as soon as the last of the herd has crossed. They wait in the cover of timber and draws until their lead cow begins to cross the highway, a most fearful obstacle, and



Imagine a sunlit, splashing, glistening and squealing band of Elk youngsters and Elk cows running and dashing in and out of the winding creek bed. This play will be repeated often, and many a nursery group remains on the willow-shielded banks of a stream for weeks in order to practice the crossing. Then, one day, the play becomes a most serious necessity and the nursery herd collects all members and starts to migrate in earnest. They cross the stream, high and swift, swollen by the melting snow. The cows often push and nose the calves ahead into the ice-cold, flooded water. The young animals are protected

often they show their marvelous discipline in waiting. I must admit that in watching them I often thought they would lose their patience, because I nearly lost mine, but they did not. The urgency of their drive to migrate uphill to the mountain summer ranges is evident despite their patience. As the journey goes on the calf becomes more and more efficient in jumping obstacles, and learns the meaning of signals given by the leading cow or its mother. This "Elk language" is continuously heard in the nursery group, be it to signal danger, flight, uneasiness, or to assure safety, or to encourage.

In general it is not too easy to see which is the leading animal in an Elk herd on the trail, but in some special situations the true structure of the group becomes apparent. For instance, on steep and narrow slopes or mountain ridges, the lesser Elk wait and give room to the leading adult cows to pass.

Elk have a fine sense of choosing a contour path in steep territory, and on my expeditions through difficult areas I used with preference the narrow, but beautifully designed, Elk-trodden trails. As the territory widens into a meadow or park, the trail vanishes because every group spreads out in such places to graze or rest and ruminate. If it is cold or windy or if hail or snow catch up with the migrating animals, they quickly search for a dense stand of timber and manage to keep their calves well protected.

I followed the routine of Elk groups day in and day out and found that with remarkable sureness they pick cool places when it is warm (noon) and relatively warm and dry places when it is chill and cold (night). In fact, I soon learned by observing the temperature and the prevailing winds where to look for the Elk. Once I asked a new assistant on the trail, "Do you smell the Elk?" The zoology student gave me a glance which I shall not forget. He thought, no doubt, that I was gradually turning into an Elk.

One early morning, I got out to take stock of a group of Elk which I had followed for several summers. They chose to stay in an area of poor range, ridges and hillsides, and somehow preferred this region to the higher summer ranges. As I tied my horse to an aspen tree near the ridge, I noticed an Elk ear moving in the deep underbrush some five yards away. I froze, and to my amazement found myself in the periphery of a resting Elk circle, comprised of twelve cows and five calves, resting and chewing the cud. The brisk wind blew straight into my face, and my horse was absolutely still, looking fascinated at the Elk. Minutes passed. My neck ached, but my eyes delighted to see the group so close. The little herd was very much at ease. Here and there an Elk shifted position to lick itself or to shake its ears for flies. Suddenly, a little Elk calf turned its head and gazed straight into my face. The big eyes looked puzzled; it sensed danger, and slowly, stiffly rose to its feet. Neither a call nor

the fact that it stiffly walked to its mother could arouse the elders. They did not count on its judgment. My heart pounded. I saw the nostrils of the lead cow moving and sniffing in the wind. The air currents on hilly slopes are hard to calculate. But none of the group save the little calf was aware of my presence. A big horsefly ended this by settling on my horse's chest; the horse stamped a foreleg so hard that the aspens shook. All seventeen Elk heads turned to our direction. Slowly and with dignity, the cows rose, and in the absence of a scent of danger, stood in doubt while the lead cow circled around us in the particular slow motion gait of Elk until she caught a little whiff of our scent. She turned, barked the flight signal, and all took off, crashing through the underbrush.

Saltlicks in the wilderness are social gathering places for many animals, but Elk and Moose seem to be the rulers of the licks, which are usually located below steep mountain sides. There is a main lick and several minor side licks for the lesser Elk, that is, for animals with lower social rating in the herd. Leaning motionless against a tree group one evening at the saltlick I found much activity going on, but everything seemed to be ruled by strict protocol of dominant and submissive behavior. Just what is it that makes an Elk a leading individual in the herd? It is hard to say, but age and experience, body weight and good health contribute a great deal to bring about this kind of personality. Non-violence characterizes Elk society, except during the rutting season or in starvation; the kicking and hitting encountered in other hoofed mammals is not often used to enforce authority and discipline. Sign stimuli take the place of crude contacts. A motion of the head and neck of the lead cow may cause a major turn or reversal of the whole group.

Let us go farther along the line of migration. Come at dawn with me to the upper valley of the winding Snake River. We cross the clear and cold waters of the river on horses and trek along the banks. The scene alternates between lush river meadows and dark-dense timber stands.

This is a young buck Wapiti, or Elk, with his antlers still in their spring velvet. Youngsters of this age are forced out of the herd during the breeding season, and they live alone or with two or three equals.

(James R. Simon Photo)

Where the trail bends we see steam rising at a distance from several places in the huge expanse of meadow. In the cold air the steaming clouds look ghostlike, as they slowly rise and thin out. We can now see that some dark figures move about in these clouds. The cry of Canada Geese grazing nearby in the river meadows floats on the chilly air. We take cover behind a huge fallen cottonwood trunk and, with the sun rising over the horizon, we can now observe Elk cows in the warm springs. There is no doubt about their pleasant feelings within the waters as they stretch their hind limbs, dipping and redipping themselves slowly and luxuriously. Their calves are nibbling and grazing in the luscious white clover-timothy beds adjoining the warm springs, and from time to time they lick and paw the ground in alkali licks and mudwallows on either side.

As we move through miles and miles of steep, gorgeous trails leading to the upper summer ranges, the goal of most Elk groups in the yearly migration, we feel how much colder it becomes. We pass snowdrifts on north slopes and the vegetation is no longer summerlike, but the vegetation of early spring. Sun and wind rule the high plateau and it seems like the top of a distant world. But where are the Elk? A huge ravine of snow banks spreads out on the slope in the distance and there are a few Elk are grazing the tender grass below it. Now we discover that the dark dots on the snowdrift are Elk resting in comfort in the pillow of snow. A huge herd, approaching a thousand head, is taking its noonday rest. Even the daily routine of Elk is changed from the early dawn and dusk activity in the valley. Up here they sleep late, usually between



the thick stands of alpine fir groups, and begin to graze when the morning sun is high. After a few hours of grazing they move to water, usually a pond or one of several creeks on the plateau. The noon hours find them resting and cooling until they begin their grazing in the afternoon in small groups. The evening brings an expedition to the saltlicks, often quite a distance away.

After we had gotten a fair picture of the Elk in their usual social existence, we proceeded to observe the behavior of groups and individuals during and after disturbances of various kinds. In such cases it was possible to study patterns of flight, cooperation among groups or within a group, and the strength of family bonds.

When a group of cows, calves and yearlings was alarmed by our pack-train, the leading Elk cow barked a warning and walked noisily forward as if to look. In the meantime the rest of the group quickly formed a single file and, with the older Elk shielding the calves, ran quietly off. When all were out of sight the cow turned and with huge jumps followed their retreat.

The social order of the group undergoes significant changes with the advancing summer as the rutting season approaches. The roaming groups of bull Elk show evidence of rising tension.

You see the big-antlered bulls still in the company of their satellites, the younger set of bulls. However, the playful sparring and tussling become more serious and the occasional enforcement of social dominance is replaced by constant bullying. The minor Elk bulls have to keep their distance and increase their obedience. Bull Elk groups split or disperse easily at such times; the survey of desirable cow groups is taken up by the stronger bulls, and eventually a harem is gathered and constantly defended against intruders who wait for their chance to outsmart the big Elk of the herd.

The younger bull Elk have to watch their every step in these trying weeks. None of the established groups wants to accept them, and their very close companions of yesterday may suddenly turn against them and fight them. Reluctantly, they begin to drift and live either alone or with two or three equals. Often they attach themselves at long distance to a group of cow Elk and rely on speedy retreat if the "boss" does decide to charge them. They serve automatically

as outposts for the large herd, warning the group of approaching danger.

Elk bulls usually take more chances of their safety than cows, but, once alarmed, they dash off without showing they have any connections with the herd. In case of two disturbing forces, the Elk will yield to the one they fear more; for instance, an Elk bull, with antlers still in velvet, fled up a hillside after meeting me on the trail. He then suddenly encountered a group of older bulls apparently unwilling to accept his company. They shook their antlers and stamped their forefeet to challenge him; he turned back toward me, coming quite close until he found a way to cross the ridge. Apparently he would rather face man than his challengers among the bull Elk.

Despite all the known facts and longtime observation, there are still many unknowns in Elk behavior. Just because we know something about their behavior in migration, one must not get the idea that the habits of the Wapiti are an open book to us Elk-watchers.

How can I explain what happened to us in a remote mountain level at some 9,000 feet elevation after two days of relentless rain and storm? Wet and hungry we had come back to our camp from a long day's ride. We pastured the horses in the meadow and built a good fire to cook a meal and dry our wet boots. The daylight was just fading when we heard a loud call in the pitchdark timber at the opposite side of the meadow. Within a minute, there was a cracking, crashing noise, and forty-two Elk cows with calves and yearlings of both sexes literally dropped from the hillside into the wet meadow and dashed forward to where our horses were grazing. Sniffing the horses, even licking the blanket of my saddle mare, the Elk began to frolic, splash and squeal in full sight of the campfire, the tepee and us two, who sat at the fire on a wet log. We were absolutely spellbound. What had happened to the dignified alertness of the mother Elk, to the timid sensitivity of the calves? Had they gone mad? As we sat, too thrilled to speak, the prancing, hopping frolic went on. Twenty-three minutes later, as mysteriously and suddenly as it began, the dance was over. One by one, and in little groups, the Wapiti melted into the dark forest. And then only the campfire made a crackling sound.



*A pair of old shoes, a tin can
and a broken bottle eliminated
the Aquarium's problem of how
to make its Toadfish feel at home.*

AN UNNATURAL NATURAL HABITAT

By JAMES W. ATZ

A CARDINAL PRINCIPLE of keeping animals in captivity is to provide them as natural a place to live as possible. There are some notable exceptions, but by and large this common-sense rule applies to all animals from the lowly sponge up to the birds and mammals. Not only are animals more likely to thrive, the more nearly their conditions of captivity approach those in the wild, but visitors find "natural habitat" exhibits more entertaining and instructive.

At the old New York Aquarium down at the Battery and in the temporary one located in our Lion House, the tanks are arranged in as natural a way as possible — within the limits of the buildings themselves, neither of which was primarily designed to exhibit fishes and other aquatic ani-

mals. One of the features of the new Aquarium planned for Coney Island will be its habitat aquaria which will contain natural assemblages of fishes swimming and carrying on their other life functions in environments that will seem to be a segment of lake or stream, a bit of swamp or shore, transported bodily indoors.

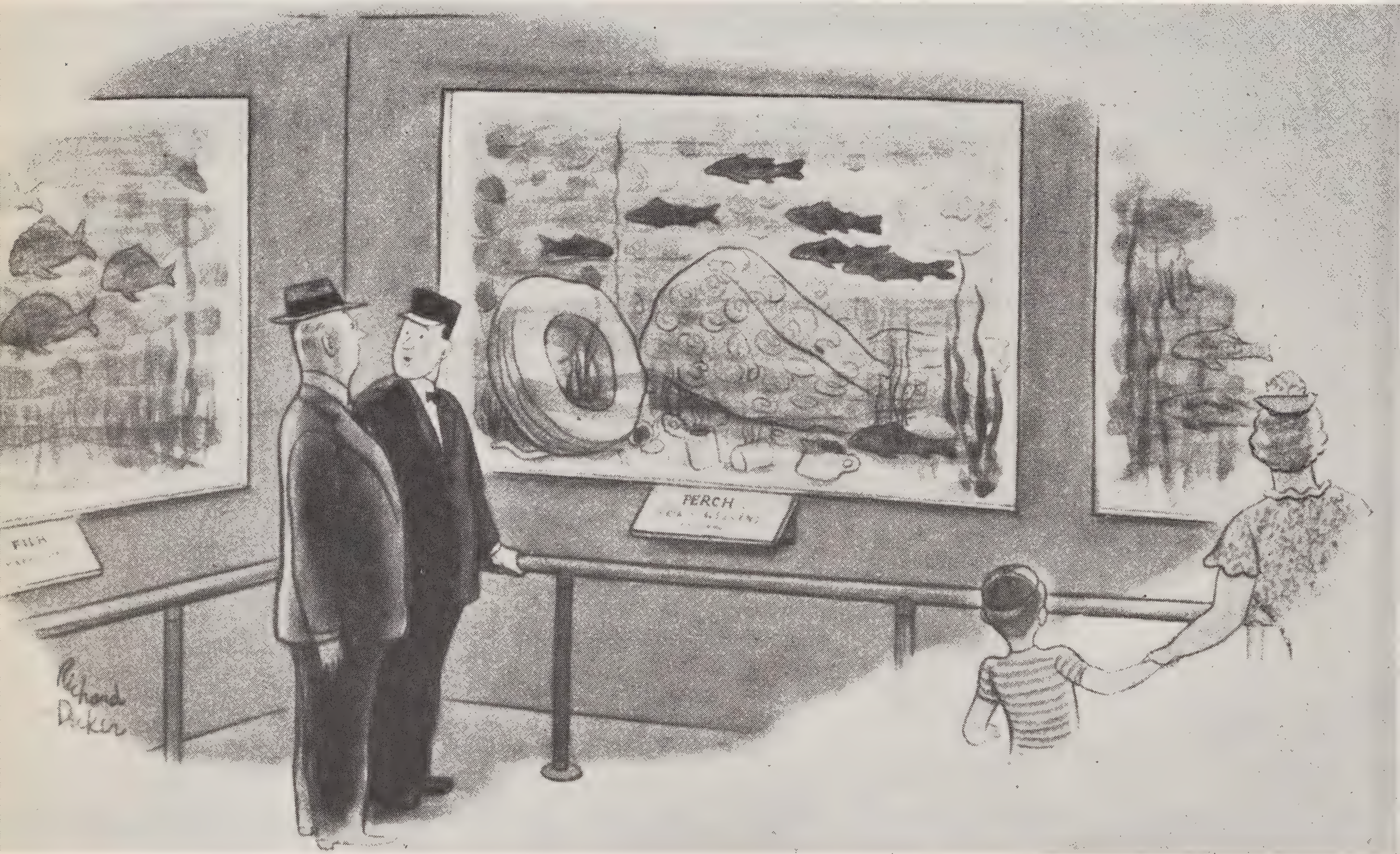
Many of the techniques we will use in the new Aquarium were developed at the old one, of course. There we learned that quite dramatic effects could be achieved with a relatively few simple but well chosen "props." The Toadfish exhibit at the Battery was a good example of this.

Toadfish are hardy creatures and they live well in captivity whether or not any serious attempt is made to make them feel at home. In a bare tank, however, they tend to clump together in one quivering mass, looking like an aggregation of overgrown tadpoles. Visitors at the old Aquarium had a hard time making out the individual fish, so closely did they nestle together and pile

on top of one another. Moreover, this essentially abnormal behavior gave but a poor idea of the real "personality" of the species — and if any kind of fish can be said to have a distinctive personality, the Toadfish is one.

Toadfish, *Opsanus tau*, are relatively common along the Atlantic coast from Cape Cod southward to Florida. They are a bottom-inhabiting species, occurring on sand or mud, sometimes in quite shallow water. They may be seen lurking under rocks or among eel grass or lying on the bottom beside some pier. Sometimes they are temporarily caught in tide pools by the ebbing water. During late spring and early summer they are most frequently found lying in a crevice or cavity of some sort, in which position they have been likened to a dog looking out of his kennel. This "kennel" may be an excavation under a stone or oyster shell, the interior of a large snail shell, or a crack in some rocky formation. More than likely, however, it will be a

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"It's an attempt to reproduce their natural surroundings, sir."

rusty tin can, an old shoe or a broken bottle. These are the nests of the Toadfish, and in metropolitan areas the artifacts of man furnish many more suitable nesting sites than are provided by nature. The Toadfish is one of the very few fishes that has benefited by man's proclivity for littering the world with trash. It is safe to say that the arrival in North America of the white man — with his crockery, his glass and metal ware, his building materials and all the other paraphernalia of his civilization — was the beginning of the greatest real estate boom in the history of the Toadfish tribe.

Nor is this the only way in which the Toadfish has been man's beneficiary, for the fish apparently thrives on the garbage and offal that all too frequently are dumped into the waters surrounding human habitations. In addition, Toadfish seem to be fairly resistant to the water pollution and low oxygen content that result from such practices.

These were the facts that were taken into consideration by the Aquarium's staff when it was decided to improve the Toadfish exhibit. What needed to be done seemed obvious — once you thought about it. A tin can, a broken bottle or two and a pair of old waterlogged shoes did the trick. When these homely items were placed in the Toadfish tank, each one was soon occupied by a fish.

The new arrangement pleased everyone. If the vigorous way the tenants defended their new homes against intruders was any indication, the Toadfish themselves were more than satisfied. Even those who could not obtain inside quarters for themselves seemed to get a certain satisfaction from occupying places immediately alongside or underneath the more desirable spots. The Aquarium staff was pleased with the more normal behavior of their charges, and visitors were both amused and amazed by the antics of the fish in their "unnatural" natural habitat.

Although the Toadfish might be called ugly, even repulsive, it more than makes up in singularity what it lacks in charm. Its behavior does not belie its appearance, however; it acts as tough as it looks. The large, strong jaws are well equipped with numerous blunt teeth which the fish is not afraid to use. Sometimes, if annoyed with a stick, a Toadfish will fasten upon

it so tenaciously that it can be lifted completely out of the water before letting go.

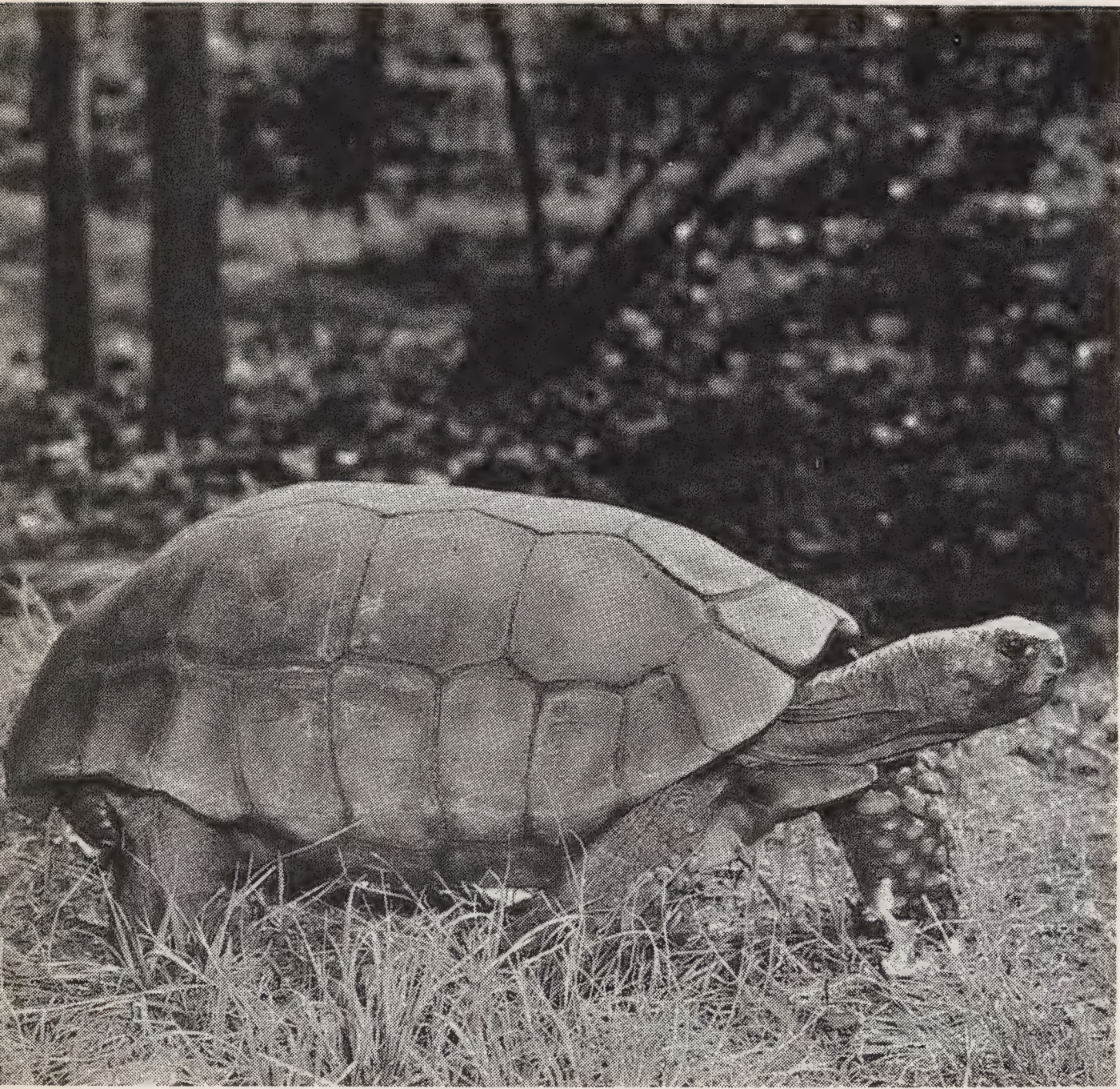
The fish is especially pugnacious during the breeding season, when it defends its nest and eggs against all comers. Early observers quite naturally assumed that the female was the parent who so bravely guarded the eggs. They did not realize that among fishes it is usually the male who performs the housekeeping duties. The male Toadfish selects the nest site and cleans it, doing some additional excavating if necessary. After the female lays her eggs, which are adhesive and about the size of a small pea, her maternal duties are over. The father fish guards the eggs and keeps them clean or circulates water over them by fanning them with his fins. He may have as many as seven hundred to care for — the result of the visits of more than one female. After ten to twenty-six days, depending upon the water temperature, the eggs hatch, but the father fish's duties are still not over. The young remain in the nest for some time while their yolk-sac is being absorbed, and the male continues to watch over them during this period.

Another interesting bit of Toadfish behavior, and one that may be intimately associated with reproduction, is the production of sounds. The "call" of the Toadfish has been described as a growl or coarse grunt of about half a second's duration.¹ The fish produces this sound by means of its air-bladder, which is equipped with special muscles that can make it vibrate. What function this underwater vocalization serves we do not know, but under conditions of nature, hydrophones have recorded a Toadfish's grunts, followed by those of another individual some distance away. Whether one fish was calling the other or was warning it to keep its distance we can only guess.

During the breeding season Toadfish typically produce a different sound. This is of higher tone, a very loud intermittent blast like a boat whistle, again about half a second long.¹ Is this the Toadfish's love call? Or is it a warning note?

At the new Aquarium, if our Toadfish prove vocal enough under captive conditions, we intend to provide their tank with a hydrophone so that visitors can hear as well as see these remarkable creatures.

¹ Fish *et al*, *Jour. Mar. Res.*, 11 (2) : 180-193, 1952.



THE OLDEST INHABITANT OF THE ZOO

By JAMES A. OLIVER

WITH THE PASSING of our venerable Hippopotamus, Pete, the title of "Oldest Non-human Resident of the Zoological Park" moves from a mammal to a reptile. The new claimant's known age is less than Pete's forty-nine years, but it is possible that the new title holder is actually an older animal. Teddy, a placid South American Tortoise (*Testudo denticulata*), has been in our reptile collection for thirty-nine years. When he was received at the Zoological Park on March 26, 1914, it was noted that he was "an exceptionally large tortoise . . . being far over the average size" — and "is evidently a very old example."

It is difficult to estimate the age of any turtle, even that of a land tortoise that possesses fairly prominent growth rings on the shields of the shell during the first few years of life. Growth rings can be counted in some turtles with good accuracy up to a maximum age of twenty-five years. In most species these rings become obscure or worn smooth after the first five or ten years. There is no record of any attempt to determine Teddy's age on arrival at the Zoological Park. To judge from the remarks on his large size at that time, he was past the size at which the rings could have been seen or counted with any degree of accuracy. Thus it is pointless to try to determine his actual age, but a minimum

age of ten years at the time of capture would be a conservative estimate. Very likely it was something more than that.

Teddy, as an individual, is of special interest for us because he was given to the Zoological Society by Theodore Roosevelt — hence the pet name Teddy. Leo E. Miller was one of two biologists who accompanied the Roosevelt Expedition to South America. From his published account of the trip, appearing in "In The Wilds of South America" (Scribner's, 1918), we learn some of the details relating to Teddy's capture. He was caught in southern Brazil where the native name "Morrocoy" is used for turtles of this species. Teddy is described by Miller as a "friendly, inactive creature" that the men called "Lizzie." Some of the native members of the expedition thought that the turtle should be used as food, but fortunately a decision was reached —

"that the animal was worthy of better treatment. It was therefore agreed upon that Lizzie should go to the Bronx Zoo. A comfortable crate was constructed, and just before loading it on the launch bound downstream, we gathered around the box and dropped an abundant supply of sliced melon and other succulent food through the bars. Then we learned an interesting bit of natural history. One of the *camaradas* had stood by until he thought enough perfectly

good food had been wasted on the tortoise. 'Don't give her all that,' he advised, 'a turtle is just like the camel and the elephant; it can go six months without eating.' We were glad to learn later that Lizzie survived the trip to New York, and proved to be the largest of her species in the zoo collection."

When the tortoise reached the Zoological Park, it was readily apparent that "Lizzie" was an unsuitable name. Thus our new addition was more appropriately named after its donor and has been affectionately known as Teddy ever since. In most tortoises the sex of adult individuals is easily ascertained by examination of the lower

shell or plastron. In male individuals the plastron is strongly concave, whereas in females it is flat or slightly convex. In the accompanying photograph of Teddy it can be seen that he has the male condition developed to a marked degree. This concavity in the males is a modification that facilitates mating in such long-shelled forms.

On the date of his arrival in New York, Teddy weighed forty pounds. In the past thirty-nine years his weight has increased only nine and three-quarters pounds, although Head Keeper Taggart, who has been here only slightly longer than Teddy, says he has always eaten eagerly and has been a healthy animal. Unfortunately, we do not have any recorded length measurements made on the arrival date, but from the notations relating to his large size at that time, it is doubtful that his length has increased very much. Today the straight line length of his shell is twenty-two inches, giving him a total length of more than two feet from the tip of his nose to the tip of his short tail.

All turtles appear to grow throughout life. However, the rate of annual growth is usually rapid in the early years and then slows to an almost imperceptible amount after the animal has attained sexual maturity. In some species of small turtles sexual maturity may be attained at

Headkeeper of Reptiles Fred Taggart, who received Teddy from the hands of Theodore Roosevelt in 1914, holds the tortoise to show the concave plastron.



three years of age, whereas in larger species as long as twenty years may be required. It was formerly thought that the large land tortoises grow at a very slow rate throughout life and thus require many years to attain their large size. As a result of observations on tortoises in captivity, we now know that early growth is more rapid. For example, a herd of eight Galapagos Tortoises (*Testudo elephantopus* subsp.) at Houston, Texas, increased their average weight from nine pounds to one hundred and sixty-four pounds in nine years. Growth from this size to the large individuals of three hundred and fifty pounds or more takes place at a slower rate.

It seems fitting and proper that the title of "Oldest Resident" should be borne by a turtle. This group of reptiles is renowned in fact and fable for its long span of life. Actually the known maximum age is less than the great age attributed to turtles in legend, but is still considerable by comparison with other forms of life. The records for several individual turtles vastly exceed the known maximum ages of all other vertebrate animals, even that of man. Except for man and the turtles, no vertebrates have a life span of much longer than sixty years. A few human beings are known to have attained an age of 115 or slightly more. Among the turtles, it is the land-dwelling tortoises that appear to have the edge on age. A Mediterranean Tortoise (*Testudo graeca*) is reported to have been kept in captivity between 102 and 125 years. An Eastern Box Turtle (*Terrapene carolina*) found in Connecticut reputedly lived for 123 years and was still alive when released.

The actual record for length of life must go to either Marion's Tortoise (*Testudo gigantea sumeirei*) of the Seychelles or a Galapagos Tortoise (*Testudo elephantopus* subsp.). The late Major Stanley S. Flower, long the official chronicler of longevity in animals, carefully investigated the records for both of these tortoises and in 1937 awarded the accolade to Marion's Tortoise. This animal had a known age of 152 years and, according to Flower, a probable age of 200 years. This was the maximum length of life definitely accredited by Flower for any animal, as of 1937. Marion's Tortoise died in 1918 as the result of an accident. It was reputedly in good health, although nearly blind.

In Major Flower's 1937 report on reptile longevity he mentions a Galapagos Tortoise that was reputedly brought to the Tonga Islands by Captain Cook in 1773 as a gift for the Queen of Tonga. This turtle was still alive in 1937, although said to be nearly blind and exhibiting signs of "extreme age." As of 1937 this tortoise was older than Marion's Tortoise, if the date of its arrival in Tonga is correct, but was not so designated by Flower. Maurice Burton, writing in "The Illustrated London News" for June 30, 1951, summarizes recent reports on the authenticity of the Tonga Tortoise. As with all of these long-lived animals, there is the constant need for care to be sure that it is the same individual animal that is under observation during the several human generations that are spanned. The Tonga Tortoise was still alive, as of last report, and its authenticity appears to be as reliable as any such record that we have. There are minor differences in the exact date of arrival of the tortoise — whether this occurred in 1773, 1774 or 1777 — but all dates agree as to the decade, as well as to the origin of the Tortoise. Differences also exist as to whether the turtle was a gift for the Queen or the King of the Tongas. Aside from these minor discrepancies the stories are remarkably consistent.

All of the accounts agree that the Tonga Tortoise is known by the native name of Tu'i Malila. In Tonganese, "Tu'i" means king. Malila is the native name for the compound of the Sacred King of Tonga. Thus Tu'i Malila is "King of the Malila compound." Recent reports state that this old tortoise is still alive and is held in high esteem and dignity by the inhabitants of the island. Mr. Robert Gibbings, an artist and author who visited the island recently and painted Tu'i Malila's portrait, reports that "when he came to sit to me for his portrait, he travelled in a royal car." Any ancient that has weathered the storms and stresses and the inevitable accidents of more than 176 years deserves such dignity and esteem.

Our Teddy is of a different species from either of these Methuselahs, but we believe he bids well to set a creditable mark himself. Not only is he now our "Oldest Resident," but he also holds the longevity record for his species of tortoise. May he have a long and pleasant life ahead!



On the sandy beach at Pelham Bay Park the Horseshoe Crabs are making their spring appearance, just as they have done for countless ages past. They are often called "Poison Tails," although they are not poisonous.

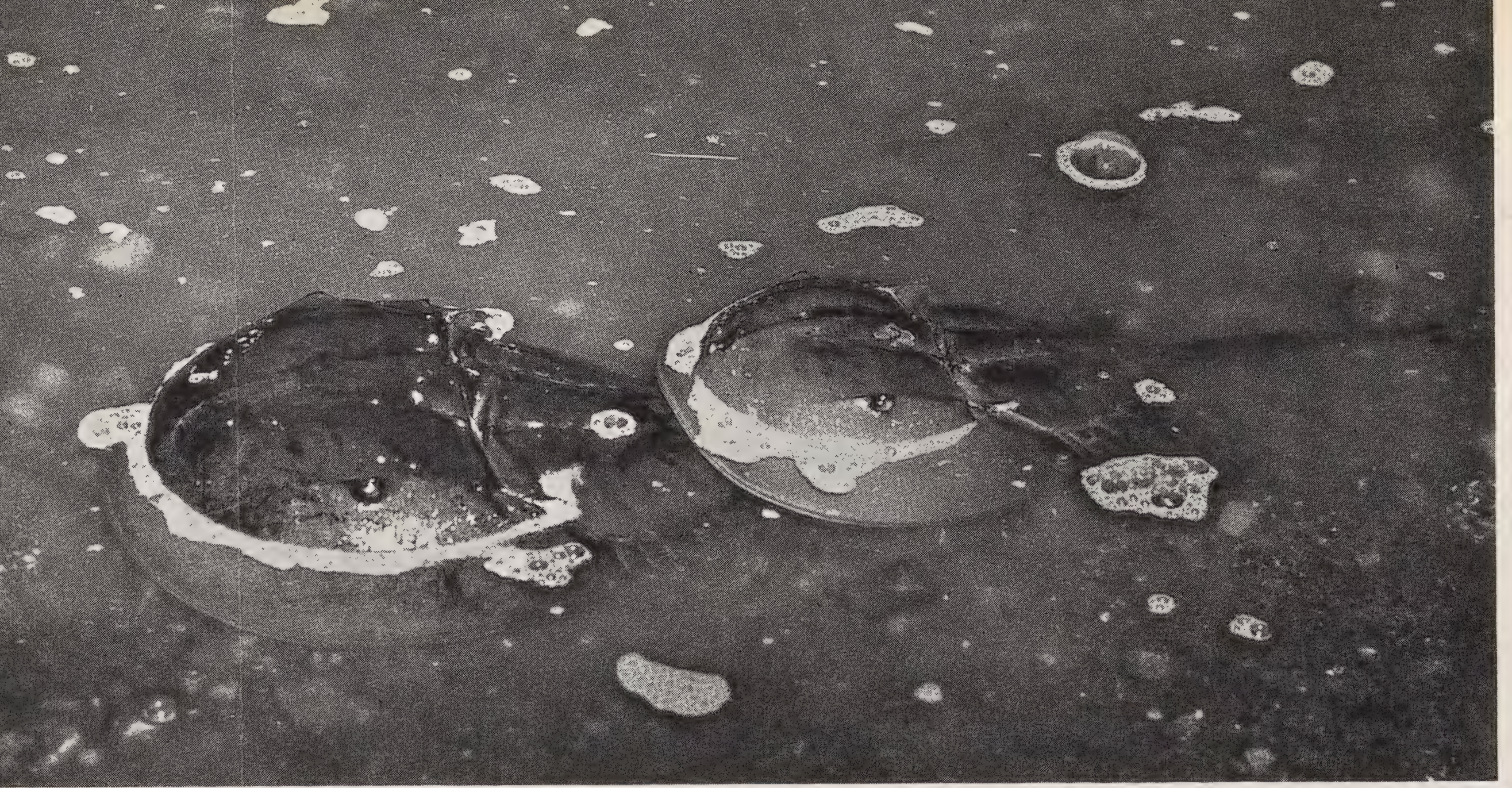
The Horseshoe Crabs Are Gathering Along the Atlantic Coast

Photographs by SAM DUNTON

MAY AND JUNE are the best time to see and study those common yet ancient sea creatures known variously as Horseshoe Crabs, King Crabs, "Poison Tails" and *Limulus polyphemus*. All along the Atlantic Coast from Yucatan to Maine they come out on the beaches to lay their eggs, earlier in the southern part of the habitat, later in the northern areas. Perfectly harmless except when a careless bather steps on a sharp-spined, castoff shell, they are nevertheless feared by many people because of the wicked-looking, stiletto-like tail. This, however, is not an organ of defense.

The lineage of *Limulus* is very old, going directly back to the Silurian Period in Europe. Although it is called a crab, its closest living relatives are the scorpions. There are four or possibly five species of Horseshoe Crabs — all but our own found in the Orient.

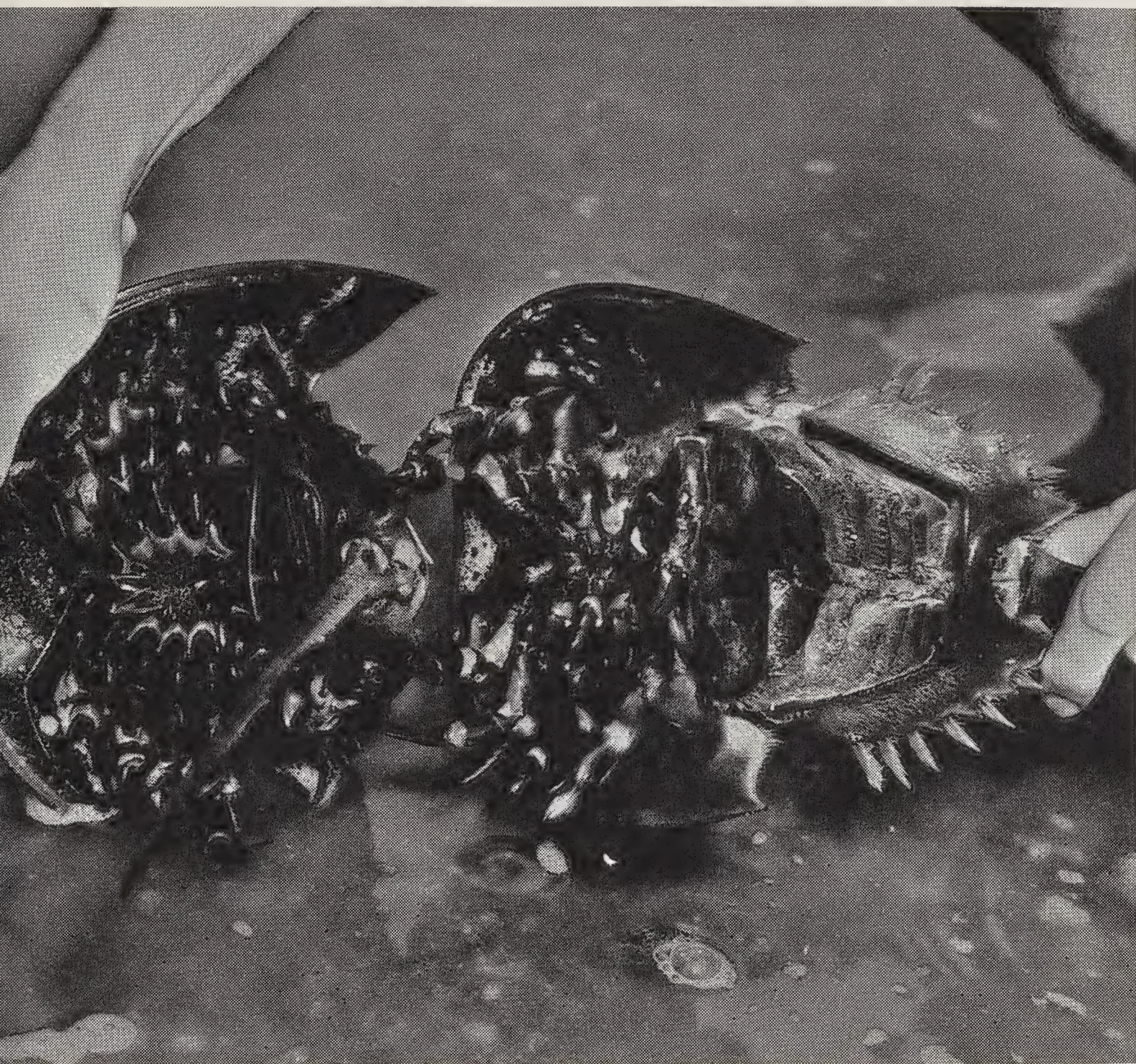
Since they are not native to European waters, Europeans look upon them as interesting rarities and they are in great demand for exhibition. The Aquarium has in the past few days made a shipment of *Limulus* to the London Aquarium — our contribution to the special "Coronation Exhibition" at that institution.



This pair of Horseshoe Crabs is swimming and crawling through the shallow water toward the beach where the eggs will be deposited. Usually, as here, the slightly smaller male gets a free ride, clasping the female by his specialized appendages.

The eggs are deposited in the sand, under shallow water. The female, at the right, is laying her eggs while the still-attached male fertilizes them. Large females contain about a quart of eggs, and males make several nests at intervals along the beach.



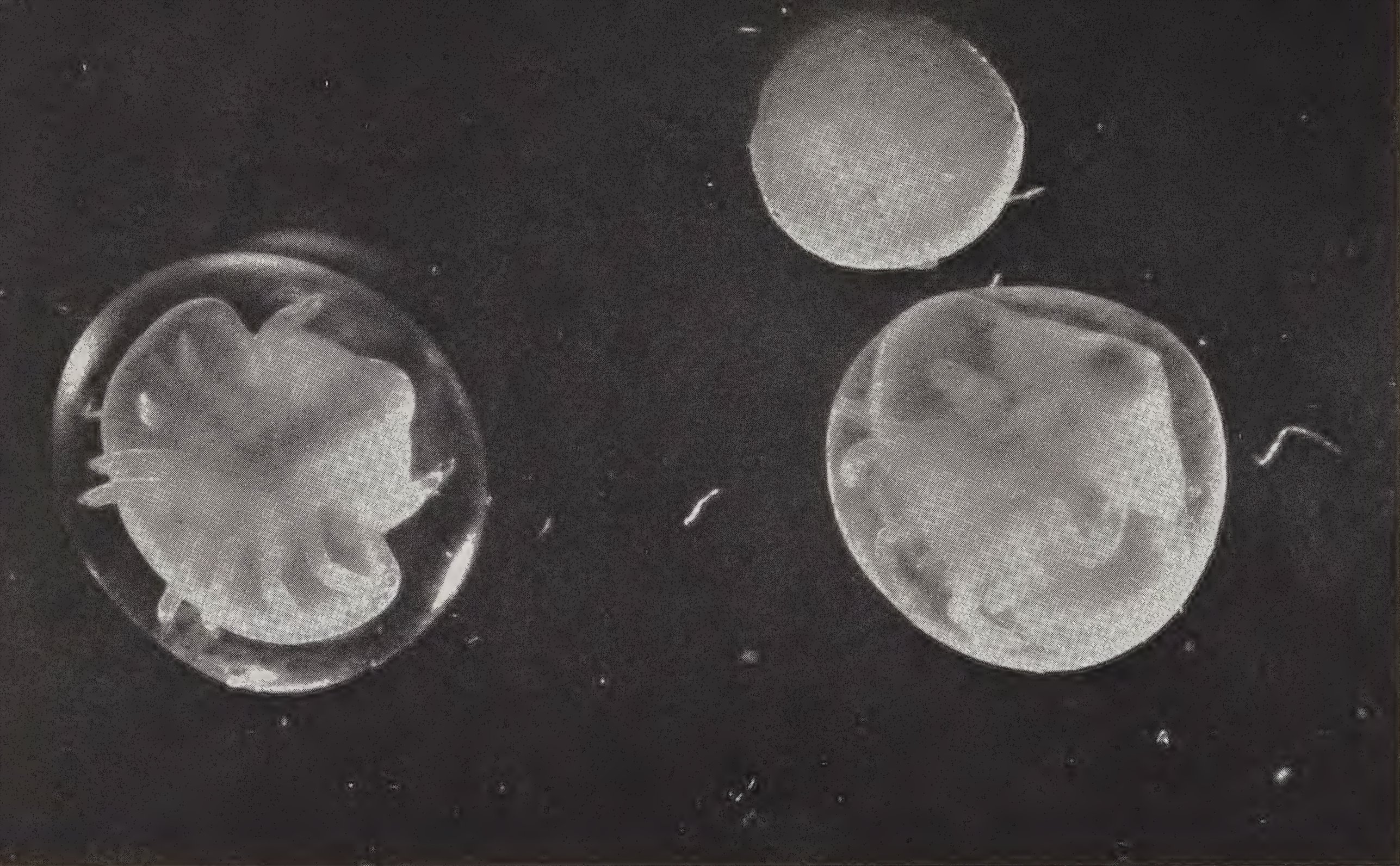


Specialized mouth appendages of the male (at right) are employed in holding onto the female's shell as they approach the beach and the eggs are fertilized. Males are usually more numerous than females, and competition for mates is keen and general.

This nest has been uncovered, to reveal the mass of tiny eggs deposited about four inches below the surface. From 200 to 300 eggs are laid in each nest. At low tide the nest may not be covered by water, but the moist sand keeps the eggs from drying out.



The minute size of the eggs appears here — each pearly sphere is about a sixteenth of an inch in diameter. An attempt was once made to market the eggs as "caviar," but they were too soft to suit the palate of the public.



In the two larger globules, the developing Horseshoe Crabs can be clearly seen. The smaller sphere is an egg that did not develop, perhaps because it was not fertilized. These and subsequent hatching photographs were made in shallow dishes of sea water in the Aquarium.



At the top is a newly-hatched crab. The translucent, empty egg-case is in the lower center, near an undeveloped egg.



Horseshoe Crabs grow by moulting and this baby is undergoing its first one. At this time the tail first becomes visible.



Young Horseshoe Crabs like these are often found on the beach in summer. In their early years they molt oftener than once a year, later at yearly intervals. They mature at 9 to 12 years; females are larger than males and may weigh up to 30 pounds.

The hard and spinelike tail is useful to the crab on the not-infrequent occasions when it is turned over. Probing and propping soon turn it back. Limpets are attached to the under side of this one's shell.





HOW THE MALE BIRD DISCOVERS THE NESTLINGS

By ALEXANDER F. SKUTCH
San Isidro del General, Costa Rica



MOST BIRDS have highly developed vocal organs. The majority of the small birds of our woods and fields are probably capable of producing a greater variety of sounds than any mammal except man, and some of the more gifted avian mimics exceed even ourselves in the range and flexibility of their voices. By no means all feathered creatures are accomplished musicians, but all, songful and songless alike, give a variety of simpler, less musical sounds which ornithologists lump together as "call notes." The number of distinct sounds which the average bird-watcher can recognize, and record by means of imitative syllables or phrases like *peep* or *pe-dee*, is for the majority of species not great, rarely exceeding a dozen or two, and this, compared with even the most primitive of existing human languages, is a very small vocabulary. But these simple sounds are delivered with a considerable diversity of modulations and inflections which we can recognize but which, in the absence of a satisfactory system of notation, we cannot adequately record. It seems likely that these subtle variations in tone are meaningful to the birds themselves, who distinguish them far more readily than we do, just as they can recognize each other as individuals with a certainty rarely achieved by us.

These so-varied calls of birds serve to apprise their companions of their location, as greetings upon coming together after an interval of separation, as warnings of approaching danger, as

threats to trespassers and rivals, as signals that food has been found — there is considerable difference in this respect from species to species. When we watch a pair of birds working together in building their nest, hatching their eggs, attending their young and outwitting their enemies, we can readily believe that without the ability to talk to each other this close cooperation would be impossible. It seems that they must possess distinct sounds or "words" to indicate the various objects and operations which enter into their daily activities. Such communication is, of course, the primary function of our language.

But a conclusion of such fundamental importance cannot be accepted without an adequate foundation of carefully controlled observations. Writers have often jumped to unwarranted conclusions about the powers of speech of animals, just as they have hastily assigned to them all sorts of miraculous capacities for conveying intelligence by means of telepathy or some mysterious "super-sense" unknown among ourselves. This matter of the modes of communication of animals of all sorts is not beyond the range of scientific investigation. Much has been done in this field in the past, with ants and bees no less than with birds and mammals, but much more remains to be learned.

One might, for example, choose one particular event in the nesting operations of a pair of closely cooperating birds and by patient observation learn whether they have the means of telling each

other about it. Events of this character are the selection of the nest site, the laying or hatching of an egg, or the departure of a youngster from the nest. Of all these occurrences, hatching seems most suitable for a study of this kind, because the student can predict within narrow limits the hour when it will take place and plan to witness it, and it causes great changes in the routine of the parent birds. Nearly always one parent sits on the nest while the eggs hatch beneath it, while the other hunts or sings or rests somewhere in the vicinity. Does the bird in closest contact with the nest hasten to convey the exciting news to its mate, as a human parent would do in corresponding circumstances? If so, how is this information transmitted? If not, how does the other parent learn that there are now nestlings which require food as well as brooding and protection? Twenty years ago I was led by my studies of the nest-life of Central American birds to ask myself these questions, and many subsequent seasons were devoted to answering them.

It is obvious that such an investigation is not to be undertaken without close familiarity with

both male and female Bluejays participate in incubation of the eggs and consequently the male is in the secret when they hatch. He shares, too, in the chore of bringing insects to the ever-gaping mouths.

the nesting habits of the species one decides to use, and even of the idiosyncracies of the particular pair of birds whose nest one watches. It is not so simple as finding a nest where the eggs are on the point of hatching, then sitting down to see what happens. First of all, one needs to know whether the male or the female, or both by turns, enter the nest to warm the eggs. And if, as with the majority of the song birds, the female alone incubates, it is essential to learn how the male spends his time during this period. Perhaps he never comes to the nest and so would not be likely to discover the nestlings unless his mate made some special effort to direct his attention to them. Or perhaps he has been in the habit of making frequent visits to inspect the nest throughout the period of incubation, and so would see his offspring soon after their hatching without any prompting by their mother.

It is well known that with some birds, as phalaropes and jacanas, the Kiwi of New Zealand, the Rhea and the tinamous of South America, the male takes charge of the eggs, and presumably also of the young, with no assistance from a mate. With hummingbirds, manakins, most ducks, and many cotingas and flycatchers, the male neither incubates nor attends the young. But perhaps in the majority of the families of birds the two sexes take turns at incubation,



then share the task of nourishing, brooding and defending their progeny. Sometimes one sex, sometimes the other, assumes the brunt of these domestic duties. Thus among most woodpeckers, and some at least of the non-parasitic cuckoos, the male is in charge of the nest through the night and is in general the more devoted parent. But with a few exceptions, such as the Rose-breasted Grosbeak and some of the swallows and vireos, the male song bird (Oscinine) fails to incubate, although nearly always he faithfully brings food to the young. Since these are the birds which breed in greatest abundance about our houses, usually in open nests more favorable for watching than the holes used by woodpeckers, kingfishers and so many others of the "songless" families, our study of how the male discovers the nestlings will deal largely with birds of this great group and of the closely allied family of American flycatchers, whose domestic economy is in general quite similar.

What contacts does the male bird maintain with the nest when he takes no part in warming the eggs? He may merely sing in neighboring trees or bushes, drive invaders from his territory, accompany his mate during her recesses from incubation, yet never closely approach the nest until after the young hatch. But often he has habits which bind him more closely to the eggs. Instead of flying off with his mate when she interrupts her sitting to forage, he may advance to the nest and guard it until she returns. This custom, as we should expect, is best developed among big, strong birds well able to drive away squirrels, small hawks and other less formidable predators. Among Central American birds it is of regular occurrence among the big Brown Jays and the Boat-billed Flycatcher, one of the largest species in its multitudinous family. But I have seen it as an individual peculiarity among some tiny flycatchers who seemed incapable of chasing even the smallest predatory creature from the eggs they so faithfully guarded. In North America, a Catbird kept watch over the nest in a barberry hedge from a neighboring hawthorn tree. Here he regularly came to sing whenever his mate flew off to hunt for food, although when she returned to cover the three blue eggs he retired to chant from a more distant perch. With him, standing guard was more than an empty

formality, for whenever I examined the nest he would buffet the back of my head while his mate pecked my intruding hand.

When the male bird instead of acting as sentinel accompanies his mate on her outings, he may escort her as she returns to her eggs, turning back at a point some yards or only a few inches distant from the nest. Among the small tropical tanagers known as euphonias, the male has the custom of flying close beside his mate as she darts into the narrow, round doorway of her roofed nest. The first time I witnessed this, it seemed to me that the blue-black and yellow male was racing his greenish mate in an effort to enter the nest before she took possession of it, but when again and again I saw the female win the spectacular race by little more than her own length, I was convinced that he made merely a formal gesture. Among the tody flycatchers, which build swinging nests with a round aperture in the side, the female's return to her eggs is the occasion of a similar "race" between her and her mate. Escorting the female, and even standing guard, may not be sufficient to give the male a view of the contents of the nest. In the first instance, he may stop short at a point too far away or, as with the euphonias and the tody flycatchers, pass too rapidly by; in the second, the sentinel's post may be too distant or low to allow a clear view of the eggs. But many male birds go from time to time to rest on the nest's rim and deliberately scrutinize its contents. Such visits of inspection, if frequent, may lead to the male's prompt discovery of the newly hatched nestlings with no intimation from his sitting mate.

Even better preparation for the discharge of paternal obligations is procured by those male birds which bring food to their incubating mates. In the majority of species in which such feedings occur, their number, perhaps two or three in a morning, is not sufficient to reduce appreciably the time the female must devote to foraging for herself and thereby increase the time she can spend warming her eggs. The importance of such *occasional* food-bringing consists in keeping the male in close contact with the nest and ensuring his prompt attention to the needs of the newly hatched babies. Occasional food-bringing has been reported for many species of finches, tanagers, wood warblers, titmice and other birds too

numerous to be listed here. Sometimes, however, as with goldfinches and some jays, the male bird brings enough food to satisfy his mate, or at least greatly to reduce the time she must spend hunting for herself. The classic example of such *sustaining* food-bringing is the hornbills of the Old World Tropics, among which at the beginning of incubation the female is immured in the nest cavity, which she never leaves until her young begin to acquire feathers, or even until they are ready to fly. The plug which the hornbills build of clay or remains of food to close off the doorway contains a slit just wide enough for the toiling male to pass in food to his sitting partner.

The most curious kind of food-bringing has received little attention from ornithologists. The male brings food to the nest, not for delivery to

his sitting mate, but for his unhatched children, still tightly enclosed within the shells, perhaps only half-formed embryos which will not hatch for a week. With a morsel in his bill he bends low over the eggs, twitters or murmurs soft notes, behaving exactly like a parent coaxing sluggish nestlings to rise up and take their meal. When his earnest efforts to dispose of the morsel in this impossible manner prove unavailing, he carries it away or devours it himself. If the female happens to be sitting when her mate comes with food for the unhatched nestlings, she may incidentally receive it, or she may disdain his offering, as I have seen with some warblers and tanagers. The most persistent of all these impatient fathers that I have discovered was a certain red Pink-headed Warbler in the Guatemalan highlands,

The female Barn Swallow probably performs most of the incubation, although the male is closely associated with all stages of the family's life and thus should soon be aware of the nestlings.



who, leaving his mate to forage down the hillside, came again and again to offer billfuls of tiny insects to her unhatched eggs. It was quite obvious that this food was intended for the offspring, not for her, although a few times she received it while sitting. Other species in which I have seen such *anticipatory* food-bringing are the Band-tailed Tityra, Buff-rumped Warbler, Crimson-backed Tanager, Song Tanager and Ash-colored Wood Pewee. This behavior suggests that the male finds the time pass slowly while his mate incubates and is eager to begin feeding nestlings, which is apparently an agreeable occupation when food is abundant. One wonders whether this premature food-bringing is confined to older males, who have had experience of earlier broods and perhaps have a mental image of the babies they vainly try to feed. Although female birds anticipate the nestlings more rarely than the males, I have seen an Ash-colored Wood Pewee and an Orange-billed Sparrow present food to intact eggs. This difference in the behavior of the sexes seems to result from the female's more intimate contact with events at the nest and her closer conformity to an innate, cyclic pattern of activities.

Thus when I began seriously to study how the male discovers the nestlings, I was aware that with many pairs of birds he has habits which might lead rather promptly to this result, even if the incubating female failed to apprise him that they had hatched. Even when I was already familiar with the general pattern of behavior of a species chosen for study, I spent at least one morning watching during the period of incubation the particular nest at which I hoped to learn how the male makes this discovery. Except with a few particularly confiding birds, all my vigils were made while I sat well concealed in a little tent of brown cloth. By carefully feeling the shell, I could usually detect as a slight roughness the first minute fracture made by the rhythmically hammering bill of the imprisoned birdling, at least twelve hours before it cut and broke away the large end and escaped. Then I would begin the crucial watch in the gray dawn of the following day. Of course I could not see the eggs while the mother bird covered them, but her restless sitting often made it clear to me that they no longer lay passively beneath her; and soon she

would reach down and pick up a piece of empty shell, to eat it or carry it away. This told me the time of hatching of the first egg with sufficient accuracy for my purposes. As for the father bird's discovery of this event, since I could not read his mind, I had to select some objective criterion. Usually his delivery of food to the new birdling was my first unequivocal intimation that he was aware of its emergence from the shell, but sometimes his close scrutiny of the interior of the nest left me without doubt that he knew what it contained.

My most careful studies were made at 20 nests of 15 species belonging to the families of American flycatchers, wrens, thrushes, vireos, wood warblers, tanagers and finches, all in the valley of El General in southern Costa Rica, and mostly about my house. Of the 20 male birds, 8 first brought food within an hour after I learned that the first egg hatched, 8 in one to 6 hours, 3 in 6 hours to 1½ days, and one between the sixth and tenth day after hatching. Those which fed their new babies most promptly were an Orange-billed Nightingale Thrush (9 minutes after hatching), a Neotropic House Wren (25 minutes), a Song Tanager (38 minutes), a Streaked Saltator (finch family — less than 40 minutes), a Yellow-bellied Elaenia (flycatcher family — 49 minutes), a Yellow-green Vireo (49 minutes), a Golden-masked Tanager (51 minutes) and a Buff-rumped Warbler (56 minutes). Usually the female parent brought food before her mate, sometimes long before. But the male House Wren fed the nestlings in the bird house 73 minutes before their mother brought food, and a male Buff-rumped Warbler more than 1½ hours before the female. At one Song Tanager's nest both parents brought their first offering together. The female Golden-masked Tanager's first feeding preceded that of her mate by only a minute; the female Nightingale-Thrush's by two minutes; while the female Yellow-bellied Elaenia first fed the nestling three minutes before her mate.

In most instances, the male's delay in bringing food for the nestlings was long enough to make me feel confident that his mate had not immediately, by some elusive process of thought-transference, apprised him that he had become a father. He had to discover their arrival by more commonplace means. Usually when he saw the babies

very soon after their hatching, this was because he had prepared himself by close attention to the nest during the period of incubation. From my preliminary watches, I could often predict whether the male at a certain nest would be prompt or tardy in discovering the nestlings. Most informative were the instances in which the male loitered in the vicinity, or accompanied his mate when she flew off for food, over a period of several hours before he took any notice of the nestlings. In such cases, if the female had been able to tell her partner that the babies were hatched, or to request his help in feeding them, I suppose that she would not have failed to do so. Often while sitting on her new nestlings she would utter notes which usually seemed to me quite like those she habitually voiced, but sometimes were decidedly different from any that I had noticed before the eggs hatched. Her mate was often close enough to hear these calls, but he never reacted to them in a fashion that made it clear that they conveyed specific information to him. Although some of my watches left puzzling questions unanswered, with none of these fifteen species of birds and a number of others that I watched for other purposes as the eggs hatched, could I convince myself that one parent had a special note to draw its mate's attention to the nestlings, or that it otherwise made an effort to inform its partner of their arrival.

Of course, when we recall that there are about 8,600 species of birds, a score of kinds is a very small sample of the whole. It may well be that with some of the bigger and supposedly more intelligent species, as crows, jays or cranes, one parent does indeed tell the other that the babies have hatched, or asks for its help in attending them. There are on record observations that make such communication seem likely, but I believe that it is exceptional among birds as a whole. The cooperation between a pair of nesting birds, so close that it rarely fails to arouse our wonder and admiration, results, then, not from their powers of communication or ability to talk to each other, but from the perfection of their innate patterns of behavior.

The adequacy of these inborn modes of conduct is attested by the fact that at most of the nests I studied the father began to bring food within a few hours after the first egg hatched.

In normal weather during the nesting season at lower elevations in the Tropics where I made these studies, there was no real need for the male to help his mate feed the two or three nestlings which formed the brood, until they were considerably bigger and made greater demands for nourishment. Thus in every instance, save that of the singularly unobservant Chipsacheery Flycatcher who required more than six days to become aware of his offspring, the male bird began feeding with a wide margin of safety. At high altitudes and high latitudes, where there is often much cold, wet weather while the eggs are hatching, prompt feeding by the male, allowing the female to brood almost constantly instead of leaving the babies exposed while she gathers their nourishment, may spell the difference between the survival and the loss of the brood.

There is one further conclusion which I believe we may draw from our study. In regions where there is abundant food throughout the year and birds are not forced to wander afar in order to survive, a considerable proportion of them live in pairs at all seasons. Edmund Selous was of the opinion that birds always remain mated when external conditions permit. These constantly mated birds fly, forage and roost together, seem to find pleasure in each other's company and to be distressed when separated from their partner. But, so far as our study of the discovery of the nestlings shows, they have not attained that higher stage of spiritual development at which the prompt sharing of thoughts and experiences adds to the joys of companionship.

SCIENTIFIC NAMES OF SPECIES MENTIONED, IN THE ORDER OF THEIR OCCURRENCE

Rose-breasted Grosbeak — *Pheucticus ludovicianus*
 Brown Jay — *Psilorhinus mexicanus*
 Boat-billed Flycatcher — *Megarhynchus pitangua*
 Catbird — *Dumetella carolinensis*
 Pink-headed Warbler — *Ergaticus versicolor*
 Band-tailed Tityra — *Tityra semifasciata*
 Buff-rumped Warbler — *Basileuterus fulvicauda*
 Crimson-backed Tanager — *Ramphocelus dimidiatus*
 Song Tanager — *Ramphocelus passerinii costaricensis*
 Ash-colored Wood Pewee — *Myiochanes cinereus*
 Orange-billed Sparrow — *Arremon aurantirostris*
 Orange-billed Nightingale-Thrush —
Catharus aurantirostris
 Neotropic House Wren — *Troglodytes musculus*
 Streaked Saltator — *Saltator albicollis*
 Yellow-bellied Elaenia — *Elaenia flavogaster*
 Yellow-green Vireo — *Vireo flavoviridis*
 Golden-masked Tanager — *Tangara nigro-cincta*
 Chipsacheery Flycatcher — *Myiozetetes similis*



Amy



Jo

Four Little Faces and Four Little Temperaments

By WILLIAM BRIDGES

A PERENNIAL CHORE in the Zoological Park is the selection of pet names for certain animals. Not for all animals; Elephants need names, but Tapirs do not; a Chimpanzee always has a pet name but only rarely does a monkey seem to warrant one. The criterion, insofar as it can be defined, is "personality" — a quality that is un-

mistakable and quickly recognized by public and scientific staff alike.

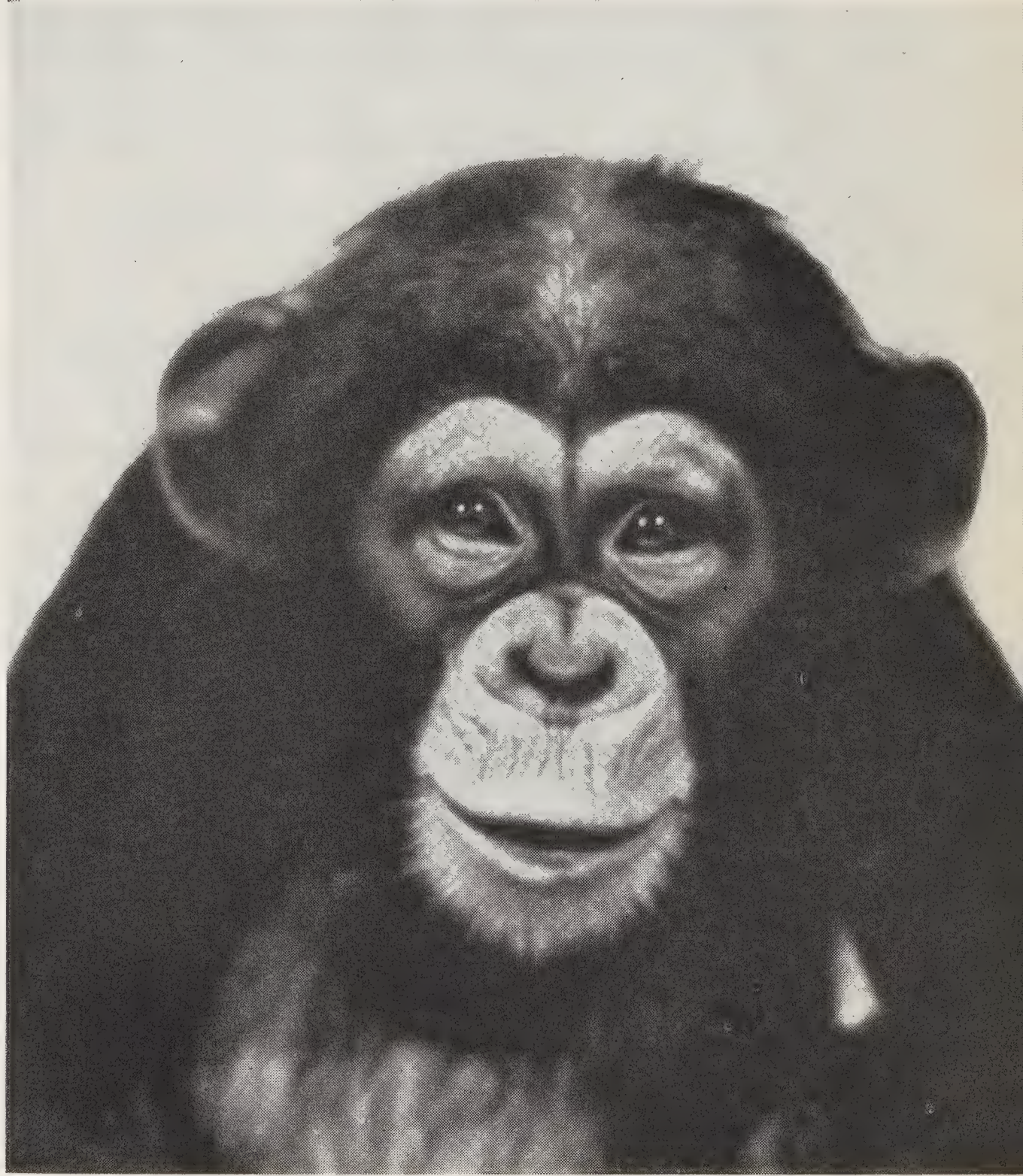
Pet names have to be, if not short, at least easily pronounced and readily remembered, but this rule is certainly not universal. Zangelima, Bamangwa and Doruma were the official and documented names of the three Elephants pre-



Meg

sented to us some years ago by the Government of the Belgian Congo, and in the Congo itself those names would be invariably used. In our Elephant House they survived only on the printed labels — to the keepers, the three animals almost immediately came to be known as Barney, Minnie and Pinky.

All this is a preface to announcement of the naming of our four new baby Black-faced Chimpanzees. They came to us from Sierra Leone on April 6 with no designations except numbers, and now that they are about to go on exhibition in the east compartment and yard of the Great Apes House, it became necessary to find appropriate pet names. Someone suggested going to literature for sources, and “Little Women” came to mind. Hence — Amy, Jo, Meg and Beth. Louisa May Alcott would not have been flattered, perhaps, and few children of the present generation are likely to recognize the names. But at



Beth

least they fulfill the requirements of being short and easy to pronounce and to remember.

While the names were taken from “Little Women,” no attempt was made to match up Chimpanzee temperaments with their namesakes. Our Amy is shy and retiring. Jo is trusting and gentle, quick to make friends with anyone. Meg is the quietest of the four, inclined to cling in baby fashion to her keeper. Beth is homely and “wild,” although she has noticeably settled down in recent weeks in the Animal Hospital, where the four babies have been awaiting preparation of their new quarters. She will in time be as amiable as the others, in all probability.

It is commonly believed that all individual wild animals look alike. Some perhaps do, to human eyes unaccustomed to observing minute differences. But even to unobservant human beings, there is no mistaking Meg for Amy, or Jo for Beth. They are four little individuals.

News from the Conservation Foundation

Fairfield Osborn to Attend Meeting in England

From July 3 to 6, Society and Foundation President Fairfield Osborn, will take part in a meeting of "a limited number of interested persons (not more than twenty)" to be held over the week-end at St. Catharine's, Cumberland Lodge, Windsor Great Park, in England. Mr. Osborn will make the opening remarks of the convocation, addressing himself to the subject of "the future production and distribution of food and the existence, use and conservation of natural resources in relation to the world's rising population and the general improvement of life."

His will be one of three papers prepared and circulated in advance among the participants, the other two topics being the ethical and the political implications of current population-resources trends.

Mr. Osborn's invitation to be present on this occasion came from Professor A. V. Hill of the University of London, President of the British Association for the Advancement of Science, who last September addressed that organization on medicine and its ancillary sciences in relation to human longevity, decreases in juvenile mortality, and the consequential and sensational population increases in many parts of the world. The bearing of this phenomenon on the world's natural resources was included in Dr. Hill's discussion.

In recognition of the fact that this problem cannot be solved by science alone and that it also requires statesmanship, moral insight and inventive capacity, the July meeting will be attended by moralists, theologians, doctors and agriculturists as well as by biologists and "some persons in public life."

Audio-Visual Program

Members of the Audio-Visual Department of the Conservation Foundation are speeding up work on the production of the short educational

films which have been in contemplation as a follow-up to the original four-year movie program now completed. A generous grant in aid will enable Messrs. Brewer and Gibbs to finish the six subjects planned and to supplement them with a guide for the use of teachers who present the films in their classrooms. The films are already in story-board form and the writing of the guide is in progress.

These films represent a radical departure in educational film techniques, employing a new method of obtaining audience participation. In rough preliminary form the principles on which they will be based have been discussed with a number of educators and have received unanimous and enthusiastic approval. Because of their brevity (approximately three minutes' running time each) it is expected that these movies can be marketed at substantially lower prices than educational films in general, and it is therefore probable that they will reach a much wider market than would otherwise be the case.

"Agenda for the Day" is the tentative title of another new film in contemplation by the Foundation staff. The grant mentioned above will enable us to do the preliminary work necessary for this production. Also, the advance investigation is being made of the possibilities for a thirteen-week radio program of educational value.

Research Projects Are Nearing Report Form

Robert G. Snider, head of the Foundation's research activities, announces that during the current year the technical reports on seven separate research projects will be completed and ready for publication. Plans are being formulated for the distribution of the material contained in these reports to magazine and newspaper editors to the end that professional writers in the popular and technical fields may be assigned to write articles for popular readership and for the readers of the technical press.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Bird of Paradise Collection On Its Way to Us

Head Keeper of Birds George Scott is expected to reach New York in late June with the greatest collection of Birds of Paradise brought into this country since General Curator Emeritus Lee S. Crandall brought back his collection from New Guinea in 1929.

The birds are a gift to the zoological parks of New York, San Diego, St. Louis and Chicago of Sir Edward Halstrom, president of the Taronga Zoological Park Trust of Sydney, and Mr. Scott is acting for all four institutions in bringing them out of the remote valley in northeastern New Guinea where they were captured. The birds were captured and held for Mr. Scott's arrival by F. W. Shaw Mayer, one of the great animal collectors of the present day.

Most of Mr. Scott's trip will be made by air. He left New York on April 25 and the exact date of his return is dependent on plane and steamer connections out of New Guinea.

Pamphlet Proves of Service

Just a year ago ANIMAL KINGDOM published an article by Dr. James A. Oliver on "The Prevention and Treatment of Snakebite," with elaborate illustrations by Photographer Sam Dunton. Subsequently the article was reprinted in pamphlet form for sale, and some 300 copies were distributed to Boy Scout Councils through the Scouts' National Office.

Two weeks ago Dr. Oliver received an interesting letter from the Scout Executive of an Oklahoma Council. "Only a few days ago, — — — of Blackwell, Oklahoma, was bitten by a 'pet' Western Diamondback Rattlesnake while attending a Boy Scout Camporee," the executive wrote. "His 'pet' was five feet and three inches long, but prompt treatment as described in your booklet saved his life. He brought the snake to the camp without permission of his Scoutmaster.

"Your booklet is the best I have seen on this subject and we would like to obtain copies for our leaders, who are now very much interested in this matter of snakebite."



In the summer of 1951 Dr. and Mrs. Frank J. Zukoski of Beirut, Lebanon, presented us with three young Arabian Gazelles that they had reared in their apartment. Now the youngsters have grown up and have babies of their own: twins and a single were born in mid-March.

Alligator-Moving Clears the Way for Reptile House Remodelling

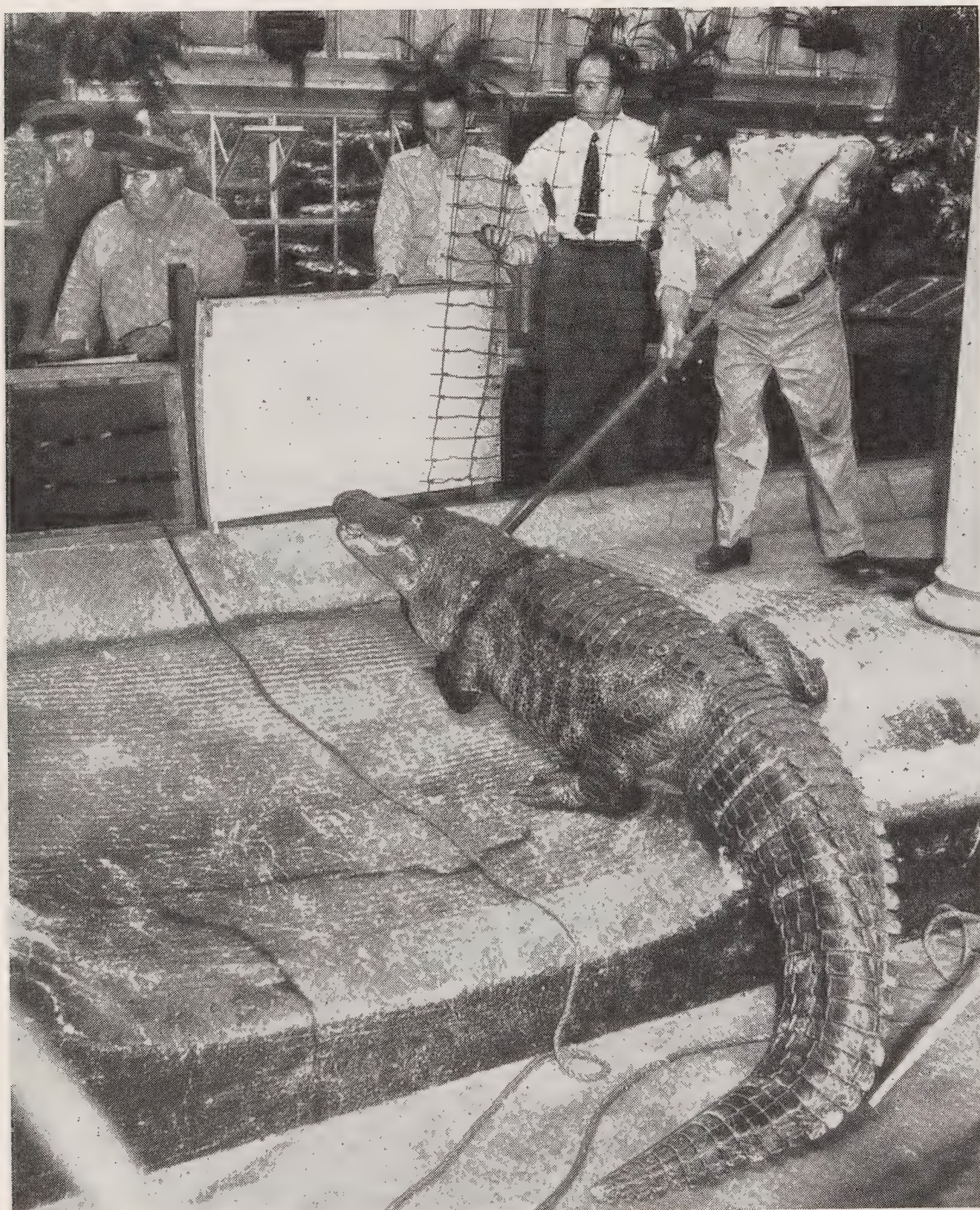
With two men pushing and half a dozen pulling on a rope around the reptile's forequarters, Tony, our 570-pound American Alligator, was easily and swiftly boxed in mid-May and was carried to temporary quarters in the Aquatic Bird House. He was the last — and most troublesome — inmate of the Reptile House to be removed before the interior is completely remodelled.

Only a handful of exhibits will remain in the building while reconstruction is in progress — the Tuatara, for one, in its refrigerated compartment in the lobby, and the Bee Tree and the Parasol Ant exhibits. Everything else, including some 300 snakes, crocodilians, lizards and frogs, have been dispersed in basements and spare storage space throughout the Zoological Park. About 200 reptiles, mostly common specimens that can easily be replaced, have been given to other zoos or research institutions in Germany, Austria,

France, San Diego, Chicago and Staten Island. Although they are outright gifts, their equivalents will come back to us next fall in the form of other specimens that we particularly need.

Most of our reptiles have been stored in the basement of the Heads & Horns Museum in the Zoo. Crocodilians and the big pythons and anacondas will spend the summer in the Aquatic Bird House and its extension. Unfortunately there can be no provision for exhibition of these particular reptiles during the summer, but nine Galapagos tortoises can be seen; they are stored in the Elephant House, in the roomy compartment formerly occupied by Pete, the Hippopotamus.

The beauties and innovations of the remodelled Reptile House will be pointed out in a fall number of *ANIMAL KINGDOM* by Dr. James A. Oliver, our Curator of Reptiles. At this stage of the reconstruction it is enough to say that the interior will be *completely* made over, to the great benefit of the public, the reptiles and the working staff.



A breathing spell in the process of moving Tony, the big Alligator, from his old pool in the Reptile House and transferring him to the Aquatic Bird House. A rope around his forequarters guided him toward the open end of the transfer box and judicious prodding induced him to go forward.



A tryout before the opening of the new Casting Pool in the Zoological Park. In the 180-by-90-foot pool, tournament bait and "skish" casting may be practiced. There are no fish in the pool.

Farm-in-the-Zoo Is Open Again After Three Years

Access to the Farm-in-the-Zoo where fine examples of livestock are exhibited has been cut off since 1949 by construction of the Bronx River Parkway Extension and the subsequent building of a new Parking Field in the northeast corner of the Zoo. All that is over now, and the Farm was reopened on May 16, to continue until early November.

Coincidentally the Casting Pool was put in operation for the first time. Built by New York State Conservation Department funds, designed by the New York City Department of Parks, it will be operated by the Zoological Society as a practice pool for fly casters, and for the present it will not be stocked with fish.

The third "opening" on May 16 was at the 327-car Parking Field adjacent to the Casting Pool. It is a badly-needed addition to the three parking fields already in operation.

Efforts to induce our two Duck-billed Platypuses to breed have been abandoned, after experimentally giving them complete seclusion last year, and they were returned to exhibition in the Platypusary on May 13. Previously they were exhibited only from 3 o'clock to 4 o'clock each afternoon; now the time has been increased and one is on exhibition from 2:00 to 3:00, the other from 3:00 to 4:00 P.M. The Duck-bills are now starting their seventh year with us.

* * *

Another litter of cubs — her sixth — is expected from Dacca, our prolific Tiger mother, at any moment. She has given us eighteen lively cubs since her own birth in the Zoological Park in 1944.

* * *

Under the editorship of Dr. Myron Gordon, the papers presented at the third conference on the Biology of Normal and Atypical Pigment

Cell Growth, held at the Zoological Park in 1951, have been published in book form. The title is "Pigment Cell Growth."

* * *

Recent births in the collection include a Guinea Baboon, a Nyala and an Eland.

PUBLICATIONS OF INTEREST

OUR ANIMAL NEIGHBORS. By Alan Devoe with Mary Berry Devoe. Pp. 278. Eleven black and white chapter head drawings by Walter Ferguson. McGraw-Hill Book Co., Inc., New York, 1953. \$3.75.

Before getting well into the body of the book, the Devoes establish themselves on a broad literary basis by claiming the status of "naturalists" with inferred abhorrence for "scientists." This is a delightful situation, of course, for any factual writer, since he feels free, as a non-expert, to wander as he fancies. Unfortunately, the position cannot be maintained consistently, for who writes of animals writes science, on whatever level. Also, even the simplest naturalist is not permitted to say there are 3,000,000 species of animals in the world (p. 6), when conservative estimates barely exceed one million. Nor may he say (p. 10) that 15,000 species of birds exist, when the careful count of a "scientist" comes to 8,590.

These mild criticisms are not intended to detract from the general interest of the book. It is well and warmly

written, the accounts of wild animal neighbors on a Hudson Valley farm are delightfully intimate and there is much more science than the authors' denials would lead one to expect. — L.S.C.

FRESH-WATER INVERTEBRATES OF THE UNITED STATES. By Robert W. Pennak. ix + 769 pp., 470 figs. Ronald Press Co., New York. \$14.00.

To encompass within a single volume all the 8,500 or so different species of backboneless animals that inhabit the fresh waters of the United States is manifestly an impossible feat. Yet such a volume would be an invaluable tool for students, research workers, fishery biologists and public health technicians. The problem then is to approach the admittedly unattainable ideal as nearly as possible.

Professor Pennak has indeed covered a prodigious amount of ground in this book. Not only are keys, descriptions and illustrations for the identification of hundreds of forms included, but copious notes on their natural history and the part they play in the economy of our waters as well. The usefulness of a book like this can hardly be overestimated. — J.W.A.

AQUARIUMS. By Anthony Evans. 115 pp., illus. Dover Publications, Inc., New York. \$.60.

This attractive and authoritative booklet is the best of all "buys" among the large number of publications now available on the care of fish and home aquaria. Some of the more expensive books offer more complete and detailed information and cover a greater number of different species, but for anyone with an eye for economy, this is a difficult item to beat. — J.W.A.

New Members of the New York Zoological Society

(Between March 1 and April 31, 1953)

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Mrs. Herbert Bandes
Jay M. Bartels
William E. Birdsall
Frederick W. Burgard
Mrs. Joseph Dalia
Michael Erlanger
Mrs. L. Funke
George F. Geis
Mrs. Harold A. Hatch
Horst von Henning
Clayton B. Jones
C. Maury Jones
Mrs. Richard Peabody Kent
Dr. Jonathan T. Lanman
Harold F. Linder
Leo Lowenstein
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John M. McMillin, Jr.
Adrian Murphy
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Miss Caroline M. Parker
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Miss Lucy Tuchman

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If you plan to move this coming autumn, please let us know as soon as you have your new address-to-be.

We always like to keep track of our friends. Send address changes to:

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The Zoological Park,
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Bulletin of the
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Vol. LVI AUGUST No. 4
1953

Issued bi-monthly at the Offices of
the New York Zoological Society,
30 East Fortieth Street, New York
16, N. Y. Editorial and Subscrip-
tion Offices, Zoological Park,
Bronx Park, New York 60, N. Y.
Title registered with United States
Patent Office • Subscription,
\$3.50 a year; single copy, 60 cents.
Same rates for all foreign coun-
tries and Canada. All pictures not
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Gems from New Guinea

ON THE DAY THIS IS WRITTEN the Zoological Park is in a state of excitement due to the arrival of a collection of Birds of Paradise — 17 individuals of 10 species. It is one of the high moments in the life of our Zoo. Only once before, just twenty-four years ago, have our bird collections been enriched by such a group of rare and beautiful newcomers.

The term *Birds of Paradise* is a thoroughly appropriate one, for the brilliance and variety of plumage of these exquisite creatures is indeed "out of this world." Skins of the birds were first brought to Europe by Magellan in 1522 and the name "Birds of Paradise" was quickly coined. As such they have been known ever since.

It is a curious fact that through the processes of evolution this extraordinary family of birds is indigenous only to the dense forests of New Guinea and nearby regions lying just below the Equator. Nature withholds many secrets and this is one of them.

It is good to realize that despite the habitat of these birds being so different in climate and environment from that of our Zoo, they nevertheless thrive in captivity. Of our first great collection, the majority were with us for long periods of time, one for a world's record of more than twenty years.

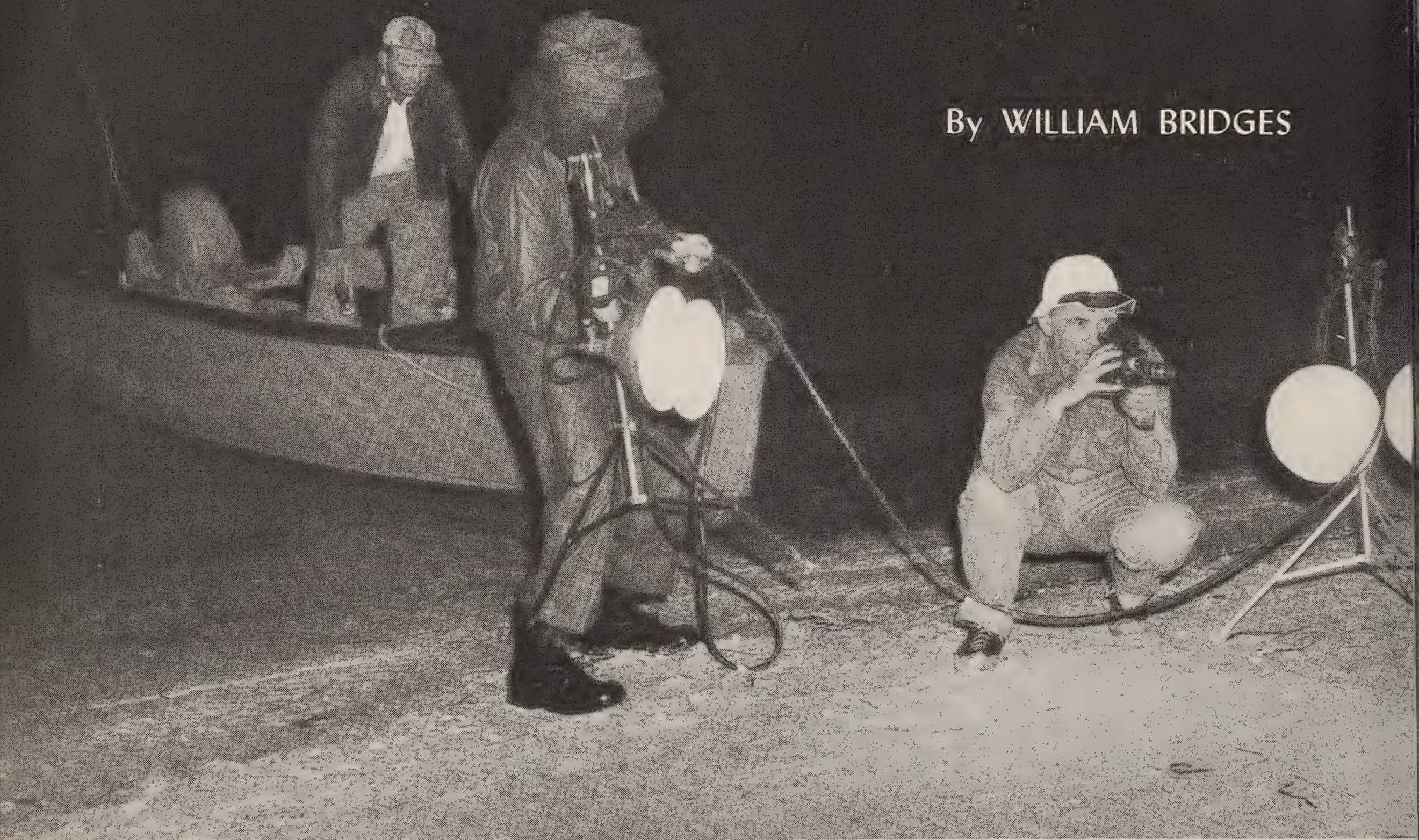
Our institution is greatly indebted to Sir Edward Hallstrom of Sydney, a Patron of our Society, for his generosity in donating these birds to us. The intricate task of making arrangements for the capture of this collection were all carried out by him and took more than a year. A warm tribute must also be paid to Mr. George Scott, our Head Keeper of Birds, who had the arduous mission of going into the interior of New Guinea and bringing the birds, without the loss of a single one, to their new home.

Fairfield Osborn

40 seconds

In A Loggerhead's Life

By WILLIAM BRIDGES



ONE OF THE MOTION PICTURES in the Zoological Society's "Living Reptile Series" will be called "The Reproduction of Reptiles." For about 40 seconds — a long time on the screen — you will see an Atlantic Loggerhead Turtle dropping her eggs into a nest hole scooped out of a sandy beach. You will see her hind flippers scraping sand over the eggs. Then she turns and scrabbles across the sand and back into the sea.

Please applaud when you see that turtle. There will be more dramatic scenes in the movie, but none that were harder to get. And a lot more than 40 seconds went into the getting of it.

As far as we know, not many people have made

On the beach at Cape Sable Photographer Dunton and his crew practice making quick landings with the lights.

a motion picture in color of Loggerheads actually laying their eggs on the beach. The reasons are pretty obvious. They lay during a very limited period, they choose lonely and generally remote beaches, and they lay only after dark. As everybody knows, color photography requires plenty of light — and electricity is seldom laid in at the beaches patronized by turtles.

These difficulties are not insuperable, however. Certain beaches in south Florida are well known as turtle nurseries in May, June and pos-

sibly July. Some naturalists and fishermen are even pretty definite about the time of laying; they say the peak comes around the full moon in May and June, when the tides are highest. Dr. Joseph C. Moore, the biologist attached to the Everglades National Park, does not hold completely with the full moon theory but he was able to pinpoint the best turtle nursery — on Middle

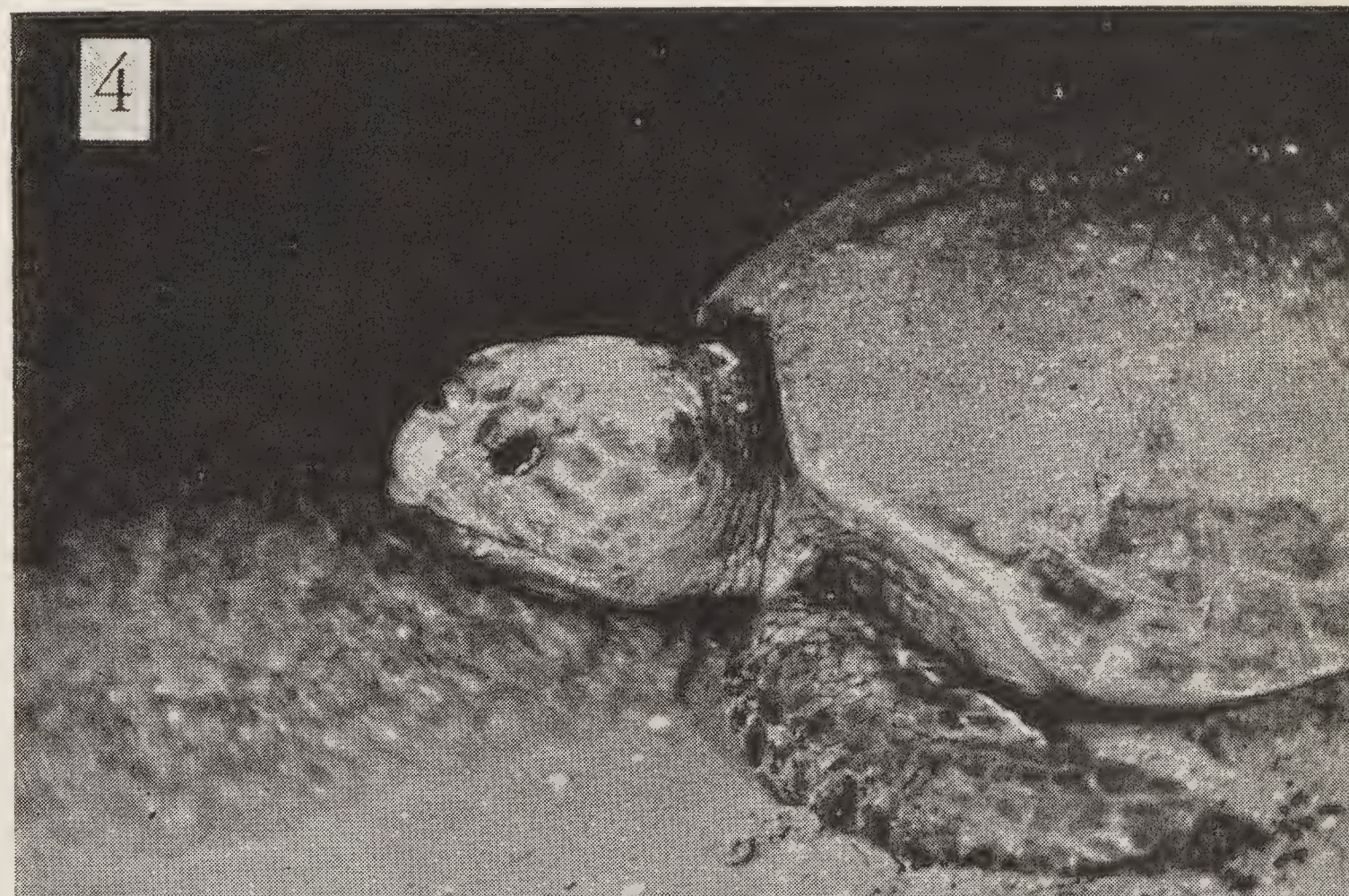


and has been scooped from under the turtle to show the extended cloaca and the dropped eggs. Here one hind flipper is vigorously scratching and into the pit to cover the eggs after laying. The nest is now completely filled and the Loggerhead is preparing to turn and head back to sea. Resting at the very edge of the water. These four pictures are scenes from the motion picture film.

Cape of the Cape Sable region, the southernmost point of the Florida mainland — and he agreed that any time around the full moon night of May 28 ought to be good.

And so it was: it was on that night that we captured the 40 seconds of film that are the reason for this article.

The problem of how to get brilliant light on an uninhabited beach was easy enough to solve. We ordered two dozen magnesium flares, each of which burns for 30 seconds. As an alternate we borrowed from the Zoo's Maintenance Department a gasoline-driven electric generator. It weighs 125 pounds — no trifle to lug over several miles of beach. That little problem was solved by what (in New York) sounded like a stroke of genius. We mounted the generator on a strap-iron frame attached to the axle and handle of an ordinary lawn roller, the kind that is lightweight itself until it is filled with water for rolling purposes. A roller does not sink into loose sand as wheels might do. At a distance of 1,200 miles from Cape Sable, it looked as if we had prepared for everything that might possibly happen.



The Zoological Society's photographic party reached Middle Cape in the early afternoon of May 26 after a two-hour voyage by outboard motorboat from a jumping-off place near the Coot Bay Ranger Station. It included Dr. James A. Oliver, the Curator of Reptiles; Sam Dunton, our Staff Photographer; Dr. Theodore Kazimiroff, a New York naturalist and outdoorsman; and myself.

Many years ago Middle Cape was a flourishing

most likely to make their nests when the tide is highest and they can swim furthest up the beach. On the night of May 26 high tide came at 10:53 P.M. Tramping the beach that afternoon we had seen many tracks and nests on the dry sand above high-tide mark and it was obvious that the turtles had been laying for days or perhaps weeks. The heaviest concentration of tracks seemed to be east of Middle Cape point, and consequently the four of us split a two-mile section



Mounting the "portable" generator on a lawn roller was considered a brilliant idea in New York — and, indeed, it did work reasonably well if distances were short. Here Dr. Oliver and Dr. Kazimiroff "fire it up."

dispersal point for sprouted coconuts and many of the coco palms up and down the Florida coast had their origin in a plantation at the spot where we landed. The bones of a wharf, now oyster-encrusted and whitened by the droppings of pelicans, marked the site. More usefully, the planter's two-room cottage had survived successive hurricanes and still stood a hundred yards from the beach. Everglades Rangers have kept its screened porch and windows in repair, although nobody uses the shack except themselves and occasional fishermen. It was no palace, but on the other hand it was a lot better than camping on the beach with the mosquitoes, midges, sandflies, green-headed flies, horseflies, no-see-ums and other curiosities of nature.

According to the best advice, Loggerheads are

of that beach into segments for patrolling, beginning soon after dark.

Under an almost full moon in a cloudless sky, there was no difficulty about seeing turtles — if there had been any turtles. Sam Dunton walked the section nearest the wharf, Dr. Kazimiroff patrolled the next link, I took the third and Dr. Oliver worked the far end. By 9:30 o'clock three of us had seen nothing remotely resembling a turtle or fresh tracks, but then Dr. Oliver strolled back with news. He had seen three turtles at the far end of the patrol area. Two were slowly cruising a few yards offshore and the third had actually come into shallow water and had crawled a short distance along the wet sand, as if undecided whether the spot was favorable. But none of the three started to climb the beach.

At any rate, we had learned that Loggerheads don't necessarily wait for the peak of the tide before starting ashore.

In the next few minutes we learned something else. Since the turtles were apparently interested in an area well to the east of the wharf where our equipment was resting, it seemed like a good idea to roll the generator nearer the probable scene of action.

So we tugged and pushed — the lawn roller *did* work, but not quite as efficiently as it seemed in New York that it would — and parked the generator and the flares far down the beach. We had just returned to the wharf to get the camera when Dr. Kazimiroff startled us.

"Turtle!" he said.

Fifty feet away a dark object bobbed in the moonpath across the water. It drifted inshore

a nest. Anyway, it turned back and the waves closed over its shell.

By then it was after 10 o'clock and the tide was creeping up toward the wrack left by the morning's high tide. With four turtles already sighted and almost an hour to go before flood tide, it looked as if we couldn't fail to get our picture on the very first night on Cape Sable.

The patrols went out again. At 10:50 — three minutes before flood — Dr. Oliver signalled with his flashlight. He had found a turtle.

His signal came from a mile down the beach. There was no time to drag the generator that far. Dunton, Kazimiroff and I grabbed camera and flares and in a matter of minutes we reached the turtle.

It was a moderate-sized specimen, lying slightly upslope at the extreme back of the beach where



Hardly a palace, but yet a very comfortable base from which to photograph Loggerheads—the two-roomed cottage on Cape Sable now used chiefly by Everglades Rangers and fishermen. Fortunately, it was screened.

and heaved itself up to the edge of the sand. Only fifty feet from where our lighting equipment *had* been — but a long, long way from where it was now!

The situation would have been unbearable if the turtle had actually come ashore while we were so unprepared. But it spared us that. It may have seen us standing there, or maybe it decided the sand wasn't the right consistency for

sand and wrack merged with grass and low bush. Apart from an occasional slight heave it showed no signs of activity until Dr. Oliver scraped away the sand from under its tail, and then we could see the extended cloaca, forming an "ovipositor." Round, white eggs the size of a golf ball were dropping every few seconds.

While the flares were being rigged on poles, Dr. Oliver measured the carapace of the animal

and found it 35 inches in straight-line length and 25 inches wide. We estimated its weight as 200 pounds — 300 pounds is about as big as they come nowadays.

There was no danger of alarming her by talking and moving around, it appeared. Sea turtles are notorious for their insouciance once they start laying. In fact, more than forty years ago S. O. Mast reported fishermen as saying that Loggerheads will go on laying even if they are turned on their backs. Mast himself carried experimentation even further — he pounded one turtle on the head with a heavy stick.

"She withdrew her head, moved slightly to one side and stopped laying, but only for a few moments," he commented.

If Mr. Mast is still interested in learning how to stop a Loggerhead from laying for at least 30 seconds, we can tell him.

Sam Dunton trained his camera on the pit where the eggs were dropping, and we lit the flares. They fizzed and spluttered and went off in a burst of brilliant white light.

The turtle stopped laying.

She just sat there. Not another egg dropped.

After 30 seconds the flares went out and the eggs started dropping again.

We tried another round of flares and the same thing happened.

While we were working fast to rig more flares, the Loggerhead came to the end of her quota and began a systematic covering of her eggs. Her hind flippers waved sideways and each stroke scooped sand into the pit.

Since the covering of the eggs was part of the nesting story, we touched off the third set of flares. Once more she stopped everything.

There were plenty of flares left but it seemed useless to continue. The turtle scratched the last sand and leaves together until the site was approximately level with the rest of the beach, and then she turned and scrabbled past us — ignoring us — down to the water and under the waves.

And that was the end of our first attempt to photograph 40 seconds of turtle-nesting on Cape Sable.

* * *

Morning brought a more cheerful outlook. After all, we had actually seen five turtles, and it was still 48 hours before the night of full moon when nesting was supposed to reach its peak. As for the turtle stopping laying when the lights went on — probably if they had been minute or minute-and-a-half flares she would have become accustomed and resumed laying. With the generator, we could out-stay her. Plans were switched, the generator was taken off the lawn roller and remounted in one of the motorboats, and we would patrol the beach as before but signal to the boat to come with lights and camera when a turtle was found.

For half that hot and mosquito-ridden day we photographed turtle tracks on the beach and excavated the nest we had watched the night before. The nest area was considerably larger than the turtle that had made it — 8 feet wide and 9 feet long, indicating that she had scraped and cast about widely before choosing the exact





spot where her eggs should fall. Once the nest is made, turtles do not return to incubate but leave the hatching to natural heat. At 10 o'clock in the morning the air temperature on the beach was 87.8 degrees and the surface of the sand registered 96.8 degrees. Ten inches below the surface the sand was quite moist and the first eggs were uncovered; in the center of the clutch the thermometer showed 84.2 degrees. Jumbled just as they fell and not separated by layers of sand, the soft, leathery eggs were still glistening white. There were 122 of them. Diameters of three were $1\frac{3}{4}$, $1\frac{5}{8}$ and $1\frac{1}{2}$ inches.

The shape of the egg hole could be roughly determined by the firmness of the undisturbed sand around it; it was approximately 11 inches wide and 21 inches deep, measuring from the surface of the dune.

able row of turtle tracks, from the sea to the sand back to the sea, can be seen in the shell us that passes as sand on Cape Sable. This is a from Middle Cape looking toward the East Cape.

Fresh Loggerhead Turtle eggs, laid only the night before. These are some of the 122 eggs in the nest of the turtle that refused to lay as long as magnesium flares were burning. It was about an average clutch.

As soon as the photography was over — a matter of only a few minutes — the eggs were replaced and sand shovelled over them. The turtle couldn't have done a better job herself.

That night we patrolled the beach from 9 P.M. until 1 A.M. We saw not one, single, solitary turtle.

* * *

Luck, if it was going to come, had to come the third and last night, the night of full moon and the highest tide, for we had to return to civilization on Friday. Cape Sable curves southeast and northwest from Middle Cape and during the morning we cruised a hundred feet offshore in both directions, looking for turtle tracks. They were everywhere. A casual count came to 51, all within two miles in either direction from Middle Cape.

From a small boat you more or less get a turtle's-eye view of the beach. Beyond the sand there are broad-leafed evergreen hammocks in the middle distance and bushes or isolated trees nearer shore. Sometimes a coco palm leaned gracefully, or the glossy leaves of a poisonwood tree formed a green blot against the sky. At night, the lighter sky would be broken up by irregular dark masses of vegetation.

Presently it occurred to Dr. Oliver that there was a relationship between the heavier vegetation and the tracks. There is always a double row of tracks, one going to the nest and the other returning, and from the sea they appear as a serrated and spraddled "V." More often than not the apex of the "V" was aimed straight at a dominating clump of trees or bushes. Looking down the beach you could predict with fair accuracy where the next tracks would appear.

We knew from walks along the beach that the favorite nesting sites were close to bushes at the upper edge of the sand. How were the turtles guided to those particular spots? Our turtle's-eye view offered a possible explanation: they cruised offshore until they saw a heavy dark area, and then headed for it — in a sort of negative phototropism.

It is an interesting theory, anyway.

That afternoon we laid our last-chance plans. Dr. Kazimiroff and Sam Dunton would stand by the loaded boat at Middle Cape point while Dr. Oliver would patrol new beach to the northwest and I would cover the old territory to the southeast. The boat would speed in either direction on signal.

High tide was to be at 1:07 A.M. Thunderstorms ringed the area, but Cape Sable was clear with a few scattered cumulus clouds glowing in the moonlight. A miraculous wind blew away the midges and mosquitoes. It was a good night for a Loggerhead to come ashore.

One did. At 1:35 o'clock in the morning Dr. Oliver saw wet tracks and he blinked his light to summon the boat. It unloaded and came back to get me, and when we were still half a mile away the beach flamed into light. Sam had his generator working.

The camera got there just in time. Dr. Oliver had discovered the turtle when she was in full

production, with eggs dropping rapidly. The sudden electric light halted her for half a minute but then she resumed laying. Moving the photo-flood lamps close to her head made no difference. The eggs continued to drop. She was a trifle larger than our first turtle — 38 inches long and 27 inches broad. We guessed her weight at 250 pounds.

Sea turtles are said to groan and heave and "cry" while laying. None of those things were noticeable in this animal, although it did seem that her "face" was somewhat streaked as if her eyes had watered at an earlier stage.

Covering and packing of the nest followed the pattern of the first turtle two nights before, but the return to the sea was different. We had supposed she would head straight for the water. Instead, she turned toward one bank of lights.

It happened to be the lights I was holding and I stepped back and to one side. The turtle followed. I retreated and she still followed. In the next few minutes Dr. Kazimiroff and I maneuvered her in a complete circle simply by retreating with the lights. Finally we backed into the water.

At the edge she halted and her head sank until her yellowish chin was lapped by the waves. Dr. Oliver touched one hind flipper and that galvanized her into action. In another two seconds the waters of Florida Bay closed over her, and unless she nests again — as some Loggerheads do — she won't come out on land again until the spring of 1954.

* * *

The Zoological Society's photographic expedition to the Everglades, only a week in duration, paid extra dividends in magnificent scenes of Alligators and their dens, nests and "nursery" pools, as well as habitat footage that will be useful in several of the "Living Reptile" films to be produced in the next two years. That so much was accomplished in so short a time is owing to the interest and cooperation of the staff of the Everglades National Park, and particularly to Park Biologist Joseph C. Moore and Rangers Winte and Maxwell. Mrs. W. J. Krome of Homestead earned our thanks by advice and many kindnesses.



The Easy Way to Feed a Platypus

By DAVID FLEAY

*Director of the Fauna Reserve at West Burleigh,
Queensland, Australia*

the problem of feeding a Platypus named Teddy.

During that summer and in the course of a severe drought, we had moved 1,250 miles from Healesville in Victoria to West Burleigh on the south coast of Queensland. The new location was to be the permanent home of "Fleay's Fauna Reserve," an era devoted to down-to-earth research on the life histories of Australian wild creatures, and after a three weeks' interval of settling in, our study collection of native mammals, birds and reptiles arrived. Including Teddy, the Duck-billed Platypus.

It was obvious that no worse time could possibly have been found for moving a Platypus. The drought was severe and the food situation not at all good. We had in fact trusted quite a lot to luck in that we didn't know whether, even in normal times, this part of Queensland was likely to yield the 600-odd earthworms or crustacean equivalents that a Platypus requires every day.

Consequently the early part of our settling-in period was largely devoted to earthworm-hunting at drain ends and in parched gardens, and the

The author of this article is the Australian naturalist who, in the spring of 1947, brought three Duck-billed Platypuses to the New York Zoological Park from rivers in the Healesville district of Victoria, Australia.

CUSTODIANSHIP of a Duck-billed Platypus is a zoological privilege granted to few. Even fewer might care to assume the responsibility that custodianship entails. I never felt the force of this generalization so much as I did about a year ago, in the height of the Australian summer of 1951-52, when I was faced with



The rather bulb-like head of a megascolid worm is shown here. It serves to anchor the animal in its burrow for a contractile

(David Fleay Photo)

nights to spotlight searching for freshwater yabbies (crayfish). The results were ominously meagre.

Then, ten days before Australian National Airways flew in with the Platypus, we made a discovery. In the course of excavating a hillside to level it as the site of Teddy's new platypusary, a 12-inch, fat, "succulent-looking" earthworm came to light. Unfortunately it broke into several pieces of its own volition, and no more worms were found for almost five weeks. That period was one of semi-starvation for poor Teddy, for the crayfish and normal-sized earthworms continued in very short supply.

However, eventually another big worm was turned up — a real whopper this time, for it was three feet long, seven-eighths of an inch in diameter, three inches in circumference, and it weighed nine ounces. Oddly, it sprayed jets of fluid like a leaky hose for a distance of eighteen inches. Like its predecessor, it broke into several pieces.

This was our first chance to learn whether the Platypus would eat one of these giant earthworms. Obviously, if it would, and if half-pound worms could be found in any numbers, our food problem was solved.

The fragments of the three-foot worm were carefully collected and that night we cut them

into Platypus-bite size and tossed them into Teddy's tank. He promptly devoured the lot!

That was a very real relief, for a Platypus will eat *only* the food it likes and would rather starve than eat something that varies in a slight (but to us indiscernible) way from the usual. It remained now only to find a reliable source of supply of big earthworms.

One morning Jim Slater returned from an early ramble along a gully bottom with an inquiry about possible subterranean springs. He had heard loud, groaning gurgles and weird bubbling sounds as he walked.

His report brought to mind the habits of the Gippsland Giant Earthworm, which have been well publicized — groaning gurgles are quite au-



dible as they contract in their tunnel-like burrows. It seemed quite likely that Jim had discovered a thriving colony of giants.

With mattock and spade we returned to the gully and began to delve beneath the iron-barks and bloodwoods among the lantana. In no time the spade cross-sectioned large tunnels, some of them an inch in diameter and others of smaller measurement, running at all angles through the rich, black soil. Some even penetrated the moist yellow clay at a spade's depth or even eighteen inches beneath the surface.



ABOVE—An inch-and-a-half egg capsule. RIGHT — a section cut across a tunnel, showing a plug cast and a hole 1" in diameter.

(David Fleay Photo)

There were so many tunnels that it was necessary to select one and follow it carefully, testing its course inch by inch with a thin stick. However, we were not careful enough and the spade chopped several inches off the quarry before we hauled its iridescent bulk out into the light.

Our first capture was a beauty, two and a half feet long in contracted condition. Placed on damp grass, it soon stretched a further eighteen inches. Like the first ones we had seen, it squirted jets of coelomic fluid from a number of dorsal pores when it was pulled from its burrow. This reaction, so typical of the many giant worms we have obtained since, is normally utilized in lubricating the burrows for easier passage of the worm. It also apparently contains a defense against soil bacteria and minute parasites.

Encouraged by such an easy capture we followed a number of burrows, some of which led us into difficulties among tree roots. We soon learned the revealing marks of a "hot" trail — wet and muddy walls of the tunnels. They indicated that the worm had retired just ahead of the spade.

Invariably the younger and smaller giants broke into two or three parts as soon as they were dug out, even though they were taken intact with no handling.

No worm casts were found above ground, but in the larger burrows we encountered "plug casts," an inch and a half in length by three-quarters of an inch diameter, with rounded ends. These were common.

From that memorable morning onwards we have dug for giant earthworms almost daily, with varying fortune. We have found them not only



in gullies but on wooded hilltops where the ground is virginal, with a moisture-holding substratum of clay. A bulldozer was brought in at one period to excavate a parking field and in the course of six hours exposed at least 35 giant worms. It is true that they were mostly in bits and pieces, but they weighed in all just eight pounds. One real giant that came out uninjured was four feet three inches long and weighed ten ounces.

In years past I had dug worms in New Zealand to feed a Kiwi and had captured "night-crawlers" in New York to feed the Duck-bills I had taken to the New York Zoological Society. I had worried about the thin, pinkish worms dug by Pitcairn Islanders for those New York Platypuses, and rejoiced over the 10,000 fat worms flown by the Society to Panama to replenish our larder en route. I felt myself experienced in the practicalities of earthworm supply, but I never expected to fall into as much luck as I have here in the West Burleigh Fauna Reserve. And a good thing it is, too, for there never was such a ravenous Platypus as Teddy. Sometimes he takes three giants a night.

We have evidently stumbled upon representatives of two if not three distinct species of earthworm, probably representing several genera. Some are brownish-black, others of flesh color, while yet another, living in the lower, flat, situations, is tougher in body structure and is unusually long in proportion to its diameter.

There is an intensely interesting field for investigation here, for little is known of Queensland's giant earthworms and it is popularly believed in Australia that they are confined to the small area of South Gippsland in Victoria.

Actually our Burleigh giants belong to the same family, Megascolicidae, as the Gippsland giant worms which are scientifically known as *Megascolides australis*. Whereas the Victorian worm has a restricted habitat in the Bass Valley vicinity, the Queensland giants are recorded from such widely separated areas as Lamington National Park, Mount Tamborine, Gympie and the suburbs of Brisbane. Mr. Heber Longman, former director of the Queensland Museum, has had scattered reports of it in north Queensland. It appears that not only is the range probably very great, but that we know next to nothing of the

maximum size or of the species that may be present.

The first scientific description of two of the Queensland giants was given only twenty years ago in a paper by W. Boardman in the *Memoirs* of the Queensland Museum. He added the species *longmani* to the genus *Digaster*, the latter in honor of Mr. Longman who had collected the worm in the rain forests of Mount Tamborine. Other large Queensland worms listed by Mr. Boardman are several species of *Woodwardiella*, including a new one, and one *Plutellus*. I have presented several specimens of our common Burleigh giants to Mr. George Mack, the present director of the Queensland Museum, and they appear to be the *Digaster longmani* such as was found on Mount Tamborine.

In a recent letter Mr. Longman told me that he found the Tamborine species by accident while a "forest devil" was being used to pull down trees. The big worms were exposed in the soft, moist soil torn up by the tree roots. Kookaburras were even more alert than the scientists, and usually were the first to spy the giant annelids among the roots. They were so quick in diving down for a meal that Mr. Longman had to be content with only one complete specimen.

During periods of really wet weather here at West Burleigh we find giant worms half way out of their burrows, lying among leaves and bark and ready for a quick contraction back underground, or, sometimes, when the rain has been torrential for several days, wholly out on the forest floor and moving actively across the ground.

Then it is that the sharp-eyed Kookaburras spot them and pounce. The birds are not able to fly with whole worms, but they often carry sections into the trees — where, like as not, a rival will seize the dangling end and a lively tug-o'-war takes place.

We have noticed that when a giant earthworm is out of its burrow and elongated to full length on a wet surface, it is remarkably tough and strong. Instead of breaking readily, as it usually does when disinterred while in a contracted position, it is fairly elastic and even difficult to carve with a knife. The usually bulbous head end used in engulfing soil and humus and in locomotion is always extremely muscular and tough

as compared with other parts of the body, and is ordinarily the one section that is beyond the chewing powers of a Platypus unless it is sliced into rather thin pieces.

It is fairly well known that earthworms, which are hermaphroditic, lay eggs in a cocoon which is secreted by the clitellum (a prominent band on the worm) and passed forward over the head. In the case of ordinary garden earthworms this is likely to be a very small, lemon-shaped body containing three or four fertilized ova, although only one usually completes development.

In the Queensland giants, however, the cocoon or egg capsule is a big, shiny, sausage-shaped object. Those we have dug out of cast-closed burrows (only half a dozen examples, all

told) were up to an inch and a half in length, glossy and smooth, olive brown in color. One in the early stages of development contained a thin, milky, nutrient fluid that escaped readily as soon as the capsule was opened.

Newly hatched giants, some six inches or less in length, are exceptionally tender and fragile. They are also the ones that are most acceptable to Teddy the Platypus.

It is an interesting sidelight on Australia's peculiar fauna that, among the 1,800-odd species of earthworms known to inhabit this planet, only here are there giants capable of making startling noises and of excavating tunnels of such proportions that snakes, lizards and big spiders often use them as ready-made homes.

On the Thread of Social Relations . . .

By WILLIAM BEEBE

A CLEARLY DEFINED SUBJECT which has been in our minds for years is correlation of the activities of certain birds — migrational, social, feeding, avoidance of enemies, various notes and unseasonal singing; all these and others in months other than those of breeding. For example, as many as twenty-three reasons for bird-flocking have so far been differentiated in Arima Valley.

This preoccupation with birds has brought into observational relief casual notes on the social instinct in other Classes and Phyla. Next to interest in the individual insect, frog, bird or mammal, as such, comes relation to its fellows.

Someone has said "No man can live unto himself alone," and this is true in spite of hermits, pole-sitters and the futile efforts of sundry misanthropes. At Simla, we know how applicable such an aphorism is to every form of animal life with which we are familiar. However, for part, and even for the dominant part of the life of certain creatures, the term Solitary applies.

Most wild animals come into the world singly, either born alive or within an eggshell of membrane or lime. They fend for themselves or are cared for by one or both parents. But their subsequent relations with their brethren, families or fellows vary as widely as the diversity of species.

In some cases there is a clear but changing social pattern throughout life; for instance, the Seven-color Parrakeets of Arima Valley very probably mate for life. The same couple comes, year after year, to the same termite nest above the monkey's cage at Simla, excavates a new nest, lays two eggs which hatch, as a rule, into brother and sister. The parents are almost inseparable even during the season of breeding. They leave the eggs and fly off together in search of food, they return at the same time to share incubation and the rearing of the unlovely fledglings. When the young can fly, the quartet flies and feeds together, and sleeps in the crowded nest.

One day a combined flock of thirty to sixty Seven-colors sweeps through the valley and our

Simla family is caught up, as iron filings rush to a magnet. Months pass and in time our pair, if it still survives, frees itself from the flock-bond and heads toward the same termite domicile. Meantime the long-suffering insects have sealed up the old tunnel and nest, so a new one must be excavated. We can never know the history of the brother and sister but we presume they have found mates from members of the flock.

It is easy to find a parallel between Parrakeets and People. Mr. and Mrs. Urbanite make their home in a cubicle carved out of a Housing Project, and rear a family. When the urge comes to travel, they all leave on a vacation to some Lake Makkowombo, or Pleasant View Inn, and for a time live in close association with fellow Urbanites, and so on.

The Family, as a single small unit, is to be found in a diversity of creatures. There is a boring beetle known as *Passalus*, with handsome, shining black, corrugated shards. It lives in the fallen logs of St. Pats and when brought into the light of day, is seen to consist of two adults and three to six offspring. *Peripatus*, that strange living fossil whose facies harks back to the starting point of worms and insects, comes, now and then, to our attention in our flower beds. It has a family life, and the adults carry about the few young upon their backs. Female Scorpions and certain Spiders transport their more numerous issue in a similar manner.

In order to avoid a tiresome sequence, we may consider the various stimuli which draw together flocks of wild beings in our valley. Sleep is one. At dawn the flickering bats begin to converge from miles up and down the valley, and to concentrate and focus on one or another cave, there to hang themselves upside down, wrap their skinny fingers about them, toga-fashion, and fall asleep.

At dusk the solitary red and black *Melpomene* Butterflies yield to an inexplicable instinct to foregather, night after night, and to quarrel and batter one another with their wings in competition for some favorite twig on which to pass the night.

One of the little Trinidad Deer, wounded by some inept hunter, escapes, only to fall dead

later. From a half mile up in the sky, the eye of a solitary Vulture sees and the bird circles down. In a very short time the news is flashed from eye to eye and Simla heaven is denuded of its vulturine population. A jungle mouse dies and the news is spread to hundreds of waiting creatures, this stimulus being through another sense, the odor of death.

Early in the evening a powerful light illuminates a white sheet outside Simla laboratory. Soon a moth appears out of the darkness, irresistibly distracted from its normal path and activities. Dozens of kinds and hundreds of individual insects appear, to remain quiescent until gathered up by enthusiastic scientists or until the light goes out. Broadway, in the theater district, may offer a parallel.

A giant Poui tree a few yards from the Laboratory bursts at dawn into a multitude of golden blossoms. The day before I saw two hummingbirds and the same number of tanagers on the branches. The next day, through twelve hours of daylight, the tree was alive with birds; in all, at least eighty-four individuals and eighteen species.

In the heart of the jungle there sometimes arises a low chorus of chirps and twitters, and we find a loose flock of birds feeding on flying insects. At a shooting party in England I have taken up my position at one of several butts, and waited while a line of beaters advanced across a field, flushing pheasants for our benefit as they came. The two incidents have a basic similarity, for the flying jungle insects are being flushed by an advancing fan of army ants, and the birds are taking advantage of the terrified flight to seize them as they try to escape. We wonder at the superspecific vocal notes understood by many different species of birds, unintentionally drawing them to the spot; or the nice differentiation between ground and arboreal feeders, those which climb tree trunks and those which snatch their prey in midair: the overcoming of the universal terror of these ant hordes, by those birds which have no nests in the vicinity.

Thus we find ever-increasing perplexities entering into the formation of temporary association of species. All these facts I have detailed are well known, but they take on new interest when strung on the thread of Social Relations.



HOLIDAY ON THE FARM (IN-THE-ZOO)

Photographs by SAM DUNTON

Thousands of holiday visitors to our Farm-in-the-Zoo this summer — like Gillian Lowes and her mother, of Chappaqua, N. Y. — will for the first time see all the varied activities that make up a farmer's typical day.





Watching the farmer milk a cow was a new experience for Gill, as it is for a very large number of our visitors. Afternoon milking always attracts a big audience.

This summer we have a fairly large-sized hog on exhibition, a Spotted Poland China. It is an excellent specimen of the lard type and its size brings exclamations of astonishment.



Another very great thrill is to see eggs actually hatching in the incubator. People often write down the date the hatch will come off, planning to return for it.



Gill and her mother call "Goodbye" to Farmer Miller after their holiday in the Farm-in-the-Zoo. They have seen representative breeds of livestock that would be the pride of any farm.

THE FISH THAT LIKE TO FIGHT

By MYRON GORDON



THE BRILLIANT Siamese Fighting Fish that we know today represent a spectacular triumph of fish breeding from seemingly unpromising "raw material." These pugnacious fish with their long, flowing and gaudy fins are the direct descendants of a small, inconspicuous and retiring creature, dull brown or green, that in the wild state seeks protection from fish-eating egrets, herons and kingfishers by hiding beneath water plants in ponds and ditches and almost any sluggish water in Thailand.

Much has been written about *Betta splendens* and its fighting behavior in and out of Siam but none of it can be accepted with greater assurance of authenticity than the remarkable on-the-spot reports of the late Dr. Hugh M. Smith, author of "The Fresh-water Fishes of Siam or Thailand."

The aquarist, he says, seeing a wild fighting fish taken from its native water habitat, would never suspect the wonderful range of color patterns that have since been realized by fanciers. Some of the more brilliant color phases, in addition to intensified reds and blues, are lavenders, iridescent greens, cornflower blue, blue and white. The fish with yellowish and reddish-

cream bodies and bright red fins were first produced about 1900, and are known to the Siamese as *pla kat khmer* (Cambodian biting fish), probably because they were originated among fanciers in French Indo-China.

During the process of domestication the size and beauty of the fishes' vertical fins have been enhanced, along with the intensification of the primitive colors and the development of new ones. The gracefully flowing, crêpe-like fins in the cultivated Bettas may be compared favorably with those of the veiltailed Japanese goldfish.

An outstanding peculiarity of the fish is its dependence on atmospheric air. In its native waters, as in a well-aerated aquarium, it cannot obtain dissolved oxygen in amounts sufficient for its needs through its gills alone. Bettas make frequent trips to the surface to take mouthfuls of air. This is stored in small amounts in accessory respiratory chambers, which are located above the gills in the form of a cavity in each side of the head. Like lungs, the cavities are supplied with a rich blood supply and their air adsorbing surfaces are increased greatly by many folds. In the wild state the fish does not loiter



when taking air at the water surface where it may be exposed to view and attacked by birds and other fish-eating animals. It projects its mouth for only an instant, expels a bubble of vitiated air and takes in a new supply. Then it retreats rapidly toward the bottom.

The pugnacious qualities of the Siamese Fighting Fish have been exploited for more than a hundred years. Up to the year 1850 or thereabouts, only wild-caught Bettas were used in Siam for fighting purposes, but eventually the demand became so great that breeding and rearing under cultivation became profitable. Elsewhere the fish are bred for their beautiful coloring and some fanciers in Siam, too, are striving now to enhance their beauty rather than their fighting prowess. It may be that the two desired characteristics, fighting ability and beauty of form and color, have been advanced simultaneously by selective methods of breeding. This points up the little-appreciated fact that fanciers may enhance the aggressive or passive behavioral characters of an animal, as well as the more obvious physical traits. Even in the hands of persons unacquainted with the workings and

application of the laws of heredity, improvements in form, size, coloration and fighting ability of Bettas have been brought about.

One might expect that the fighting instinct would develop at the approach of maturity. As a matter of fact, the pugnacious tendency may appear in highly bred fish that are only two months old. The most persistent fighters are, of course, mature, and they will fight at almost every opportunity. Under favorable conditions the fighting fish in Siam has a life expectancy of slightly more than two years.

Dr. Smith, during his twelve-year residence in Siam, discovered that male fishes caught in open waters and taken indoors will, after a few days, readily respond to an opportunity to fight. The fighting stamina of the wild fishes, he says, is not well developed for present-day requirements in Thailand, and practically all matched combats

Flaunting its gaudy fins, a domesticated Betta swims ahead of a dull-colored and unspectacular, wild-type fish. Both these fish are males.

are now between fishes that have been specially bred in captivity. Wild fishes fail to show any pugnacious spirit after a few minutes of attack; an encounter that lasts more than 15 to 20 minutes is unusual. On the other hand, in fishes reared under careful domestication and intelligent selection of fighting parents, the inherent desire and ability to fight are markedly strengthened. Well-matched fishes may continue their attacks hour after hour without intermission, with only brief excursions to the surface for air. Some of Dr. Smith's fishes remained pugnacious after six hours of uninterrupted combat, although they do not ordinarily fight more than three hours. A few extraordinary fish have struggled in combat for a whole day and night.

In Siam, as in some other countries into which the fish has been introduced, the usual procedure in arranging a fight is to select two males of approximately the same size and bring them together in separate jars. If they spread their fins, show their colors and make head-on efforts to reach each other, they are placed together in the same vessel. Under the stress of excitement in seeing the approach of another male, the fish exhibits a remarkable change. All the fins are

widely spread, the gill membranes are expanded and project like a frill or a ruff, resembling the raised hackles of a fighting cock. The fighting fish's entire body and fins become intensely suffused with a lustrous blue or red color, which place them among the most beautiful of all freshwater fishes.

After indulging in a preliminary display of spread fins and expanding, bright red gill membranes, they assume a common sparring position. The fishes come side by side with the heads pointing in the same direction and with one fish slightly behind the other. They may hold this position only a few seconds or up to several minutes. Then they attack with great swiftness. They repeat their assaults at short intervals after rising to the surface for air and returning to their sparring attitude.

The most common points of attack are the anal, caudal and dorsal fins. In contests between well-matched fishes the fins are likely to be torn or split and in some they may be reduced to stubs.

Dr. Smith points out that extensive damage of

the fins impairs the swimming, steering and balancing powers of a fish and hence places it at a disadvantage. In evenly-matched fighters this is not likely to be a final factor in deciding the issue, however. Sometimes they attack the side of the body, nipping off a scale or clumps of scales. The gill covers also may be bitten and some slight injury may be done to the underlying gills. This is probably more serious.

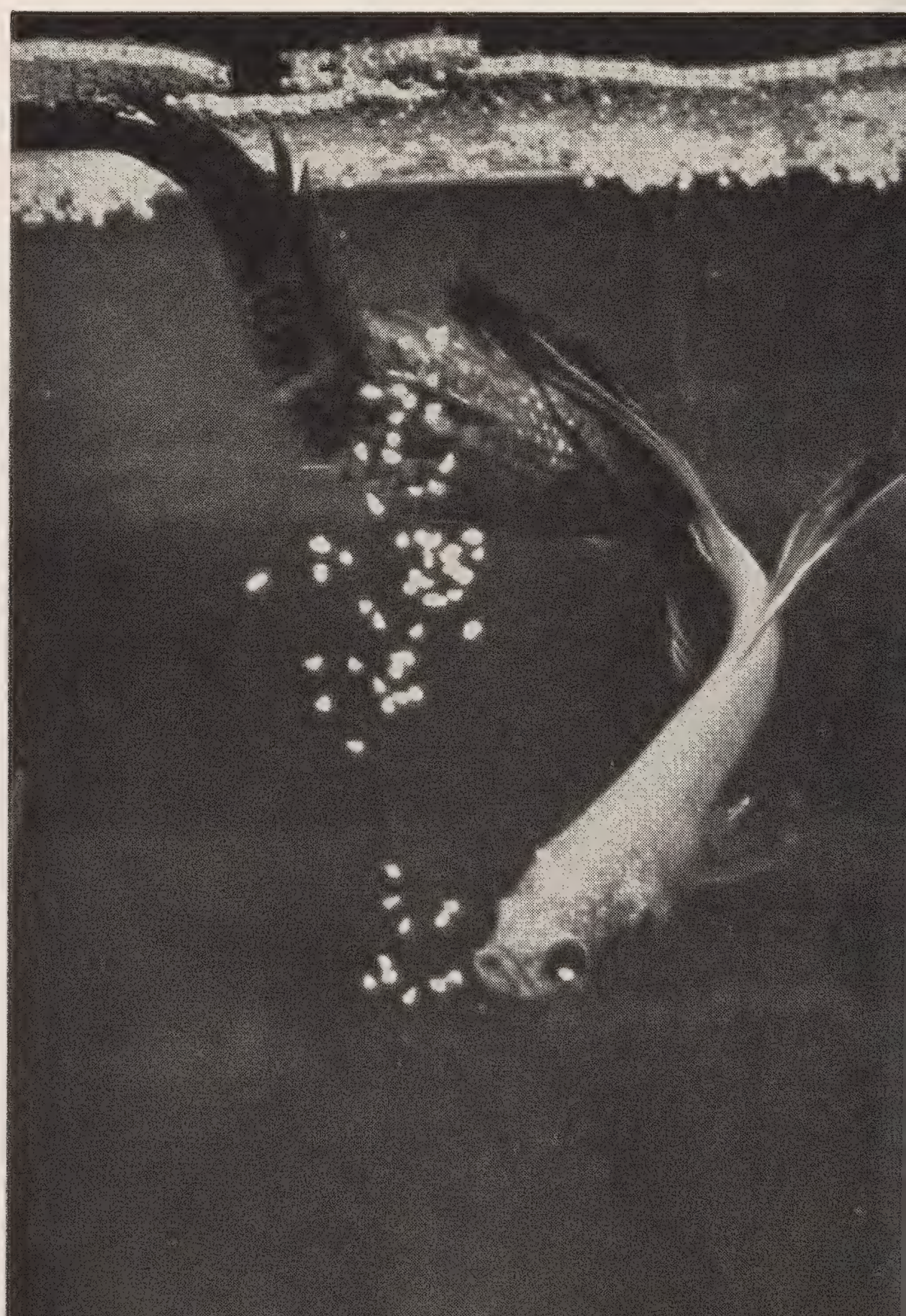
Occasionally the fishes come at each other in a head-on attack and lock jaws. When so joined they sometimes rotate in their struggle, gradually settling to the bottom and remaining perfectly still for about 10 to 20 seconds. The hold is then broken and they rapidly seek the surface for air, after which they resume their ordinary fighting tactics. The locked-jaw union is mutually disadvantageous because it interferes with respiration and it lasts only as long as the fishes can "hold their breath."

During the short interludes in fighting when the demand for oxygen forces the fishes to go to the surface for gulps of air, attacks are always

These Bettas are spawning and the fertilized eggs are beginning to fall. The bubble nest can be seen above the fish.



One spawning over, the male (light in color) has darted below the female and is beginning to gather eggs in his mouth.



suspended. Dr. Smith has never known one fish to assail another at such a time, and he remarked that in the fighting fish's code of ethics this period is, literally, a breathing spell. Fighting contests are decided by the general exhaustion of the combatants rather than by a definite amount of injury or a knock-out assault. Sooner or later one fish assumes a position of attack but the other may lack the ability or desire to continue the fight and swims away. Since the fishes' weapons are the teeth, and these are small, no permanent damage is done. Dr. Smith never saw a victorious or a vanquished fish that suffered serious bodily injury. When one fish retires, the engagement is declared over. The wagers, if any, are paid, and the owners put their gladiators into jars and go their respective ways.

At the end of a protracted contest both fishes may look quite shabby because of their mutilated fins — but just the same, if permitted, they would fight again the next day. The fins regenerate rapidly and completely and at the end of a few weeks may show little sign of injury. Loss of

the next stage is for the male to carry the eggs up to the nest and with a quick motion eject them into the frothy mass.



scales may be more serious, for this exposes them to infection, but if proper precautions are taken in advance, this, too, may be avoided. A bath in a low saline solution often prevents infection.

After seeing many hundreds of exhibitions, Dr. Smith found nothing brutal, cruel or repulsive in fighting-fish contests. "The participants," he says, "seem to get so much satisfaction from their encounters, their physical discomfort is apparently so negligible, and their recovery is so complete that there is little occasion to expend sympathy over them, while their graceful movements, muscular agility, acumen, tenacity, and wonderful color displays cannot fail to arouse enthusiasm even in the most sensitive spectators."

WHEN A MALE FIGHTING FISH is seen making a nest of bubbles at the surface of the water in an aquarium, that is the time to introduce a suitable female. The chances are that next morning the frothy nest will contain several hundred minute eggs so transparent that they are hardly distinguishable from the bubbles.

Many aquarists have witnessed the spawning behavior of the fish and motion pictures have recorded the sequence of events. In spawning, the fish swim near the surface close to the nest, meet, embrace and release ova and sperm. As a small batch of fertilized eggs slowly sinks toward the bottom, the parents disengage, swim down, take the eggs into their mouths, return quickly to the surface and blow them into the prepared nest.

Before the pair is spent they may embrace, release their roe and milt and carry their numerous potential progeny to the nest several times over a period of two hours. After the final embrace and the immediate postnuptial tidying up, the female's duties are over; all subsequent care of the impregnated eggs becomes the sole responsibility of the male. It is a large task.

At one spawning about 400 to 500 eggs have been placed into the nest and these are guarded incessantly. In water at temperatures between 80° F. and 85° F., the eggs hatch in 30 to 40 hours. During this period, should any eggs drop from the nest — and some usually do — the male finds them, picks them up in his mouth and spews them back into the sanctuary of their bubbly mound.

After they hatch, the fry remain in the nest until their yolk sacs are absorbed. At the same time their bodies and fins develop. If they should stray or be shaken out of the nest before they are old enough, the male carries them and gently ejects them into the nest. During the entire period of infantile helplessness the male repeatedly takes the young in his mouth and blows them out with new bubbles, thus insuring proper oxygenation. In the process of laving the eggs and young the male covers them with a substance which probably protects them from bacterial infection.

Throughout the nesting period the male fish is extremely busy and his vigilance never relaxes. In addition to making and maintaining the bubble nest, replacing the eggs that may drop from it, rounding up the straggling young, and mouthing the young at intervals, he is constantly on the alert to protect the eggs and young from large intruders that may devour them. One offender is the mother fish. In the wild state, she is forcefully driven off and kept at a distance. In the restricted quarters of an aquarium she must be removed as soon as egg laying is completed, otherwise she may be killed by the male.

The forbearance of the male from eating his own eggs and young is not due to any temporary impediment to his digestive system. He can and does eat mosquito larvae or other suitable food throughout his period of guard duty. Apparently his behavior is controlled to some measure by a hormonal influence which is highest during spawning activity. When the level of his paternal behavior is high he cannot, or does not, distinguish between his own young and those of another parent introduced into his aquarium. Foster offspring receive the same care as his own.

If a male is taken away from his nest, the subtle physiological adjustment is usually upset. Returned after a few days, he may promptly devour his young.

The bubble-blowing habit, so important in the lives of the fighting fish, is well developed. The bubbles are made with the aid of a viscid mucous secretion of the mouth or pharynx, which tends to keep them in a compact mass. The bubbles gradually lose their stickiness and become scattered or ruptured, and the male is constantly rebuilding them.

THE FIGHTING FISH is a confirmed carnivore. Its dental equipment and short intestine are characteristic of a meat-eating fish.

In a wild state it renders a useful service to mankind and to land animals generally by its destruction of mosquito larvae. The fish inhabits the same kinds of weedy waters in which the eggs of various mosquitoes are laid and hatched, and mosquito larvae are the favorite, often the exclusive, food throughout the year. As the fish's appetite is keen, its digestion rapid and its feeding activities more or less continuous during daylight, the daily consumption of potential blood-sucking pests is large. Based on the observed requirements and the actual consumption of mosquito larvae by fighting fish in small aquaria, Dr. Smith estimates an annual intake of 10,000 to 15,000 larvae per adult wild fish under normal conditions.

When the young fishes first begin to feed, their mouths are too small to eat mosquito larvae, and during a period of 10 to 12 days following the absorption of the yolk sac they subsist chiefly on minute crustaceans, rotifers and protozoa. As these creatures abound in the water, the fry have no food problem in their early days.

The preference is for living, moving food. Given the choice of both active and dead larvae, the fishes may entirely reject the latter until driven by extreme hunger. Under the stress of necessity they will take scraps of beef, fish or shrimp.

Dr. Smith says that in Siam mosquito larvae are regarded as essential for the proper nourishment of fish under domestication. Coolies spend much time in locating breeding places of mosquitoes, collecting the larvae with fine-mesh nets, separating the larvae from plant and animal debris, and feeding the clean larvae to the fish. The wrigglers, held in a coffee cup or rice bowl, are administered with a spoon.

In the capital of Siam where there are some thousands of amateur fighting fish fanciers and many professional breeders and dealers, there is a large and steady demand for mosquito larvae. To meet this demand, which becomes acute during the dry season, Dr. Smith reports that there has sprung up a strange and thriving business of breeding mosquitoes and selling their larvae to owners of fighting fish.

LIONS- THE PROUD, BIG CATS



By GEORGE G. GOODWIN

Associate Curator, Department of Mammals, American Museum of Natural History

I GOT MY INTRODUCTION to the big tawny cat at close quarters on the Serengeti Plains in 1938. My tent was pitched beside a big rock some distance away from the main camp. Late the very first evening I heard the scratch of a Lion's claws as it came down off the rock. A little while later I fancied I heard footsteps on the grass outside my mosquito screen. Sure enough, dimly silhouetted against the dark sky was a full grown Lioness peering into my tent. She seemed friendly enough — just curious. Getting out of bed I walked over to the screen and flashed my light into her face, suggesting that she try the cook tent down the line. With that the big cat serenely turned about and I watched her fade slowly away in the darkness. I have learned a lot about Lions since then, and a cold shiver runs down my back when I think of that incident and several other friendly gestures that I made to Lions. I must have seen seventy-five Lions in Kenya and Tanganyika during a couple of months. At one time I counted twenty-five around me, mostly Lionesses with their cubs, some very small, while others were about one-third grown. It was impossible to determine

which cubs belonged to which female. The Lionesses I fed ate sparingly and lay down in the shade, leaving the cubs to tear the meat apart as best they could by themselves. Not once did they impress me as being either dangerous or ferocious. An old granddaddy with a long black mane, sitting under a thorn tree, was not the least interested in food. He seemed awfully bored with life, yawned several times, got up and lazily sauntered off for a drink in a nearby stream, then snoozed off again. I remember one old Lion that looked so thin and hungry that I decided to do something about it and brought him a Wart-hog which he carried off to the shade of a thorn tree with a little Jackal following proudly at his heels.

It has always been a temptation to retain childhood fancies. Most of us were brought up on the unforgettable, enchanting belief that the Lion is the King of Beasts. Even grown-ups look upon the Lion as the venerated embodiment of boldness, bravery and courage. He does, indeed, look the part of a royal personage — carries himself with dignity and with what appears to be unsubjugated pride. After all, the Lion is the biggest



and strongest carnivore in all of Africa. Every wild creature on the veldt has a great respect for the Lion and most fear him. If he is conscious of himself at all, his concept of ego must be entirely different from ours and his behavior can never be interpreted in terms of human conduct. Animal trainers will tell you that a Lion can be trained and taught to perform — that it may even respond with a certain amount of what could be called loyalty and friendship. But a Lion can never be really tamed. A trainer who forgets this rule once may never live to get a second chance. A man may live after being attacked and mauled by a Leopard, Bear, Hyena or a bull. Carl Akeley fought off a wounded Leopard that charged him and eventually succeeded in killing the beast by pressing on its ribs with his knee until it stopped breathing. Had it been a wounded Lion that attacked Akeley, death would have been inevitable and swift.

Lions are individualists and an endless chain of surprises, each one living and behaving differently, yet all are basically the same, sociable among themselves, bearing no enmity toward their fellow creatures. A Lion will kill with lightning speed but will share its spoils good-naturedly with its fellows. Hunger appeased, it is no longer to be feared. Wild game shows little concern for a well fed Lion, so long as they can see it out in the open. Instinctively, they know that there is no danger of attack for the time being and will continue to feed, unperturbed by the presence of several Lions. The

Lions are sociable. After a kill they will share the spoils good-naturedly with others of their own kind, and all eat together.

Photo by the Author

Lion is the only big cat that is socially inclined and loves company. It often travels in companies of half a dozen or more. Such a gathering is referred to as a pride. A family of Cheetahs may stay together until the cubs are a year old but it is a rare occasion when more than two adults are seen together.

A grown Lion represents between four and five hundred pounds of fighting muscles and bone, measuring seven feet in length without the three feet of tufted tail. It may stand three feet, four inches or more at the shoulder. Lionesses are smaller and weigh up to about three hundred pounds. A Lion is not in its prime until it is five or six years old.

The Lion's mane, like the beard in man, begins to grow when approaching maturity — at three years in the animal — but it is not complete until the sixth year. Occasionally, a cub will start to show signs of a mane at an earlier stage, but this is unusual. The Lion's mane is a luxuriant growth of hair that surrounds the face and extends back to the shoulders. It may be almost black, but in most the color varies to a comparatively pale sandy or tawny color. The Cape Lion was noted for its heavy black mane and the Barbary Lion not only had a black mane but the hair on the chest and belly formed a long, luxuri-

ant fringe. On none of the existing forms are such manes developed and some east African Lions are reported to be maneless. The rest of the Lion's body is covered with short, close, tawny fur except, of course, for the blackish tuft of hair at the end of the tail. Concealed here is the so-called "claw" or "nail." It is present but represents no more than a scaly attachment to the skin at the tip of the last vertebra. Some other animals have an even better-developed spur at the end of the tail but it seems to serve no useful purpose.

The Lion's big guns are its enormous canine teeth that it uses for stabbing and killing. They are set in cantilever jaws, capable of biting through the neck of a Zebra or cracking the skull of a man like matchwood. A pair of sharp shearing teeth on each side of the mouth can cut the toughest sinew and flesh. These teeth do not meet but their blades sheer past each other like scissors. There are no bone crushers in its mouth like the broad molar teeth we find in a dog or bear.

A Lion's paw is a mighty weapon in itself, capable of breaking a man's back with one blow. The paws, especially the ones in front, are armed with powerful hooked claws compressed on the sides to form a cutting edge. The claws are kept securely encased in a sheath to protect their sharp edges and needle points. In this way the Lion can trot over rough and stony ground without harm to its claws. When the Lion strikes, the claws are bared and extended to their full deadly length.

The spoor of the Lion is easily distinguished from that of a Lioness. Those of the forefeet of the Lion (5" x 4½") are much larger than the hind, whereas the fore and hind feet of a Lioness are nearly equal in size.

To know the Lion, you must meet him on his own grounds and on his own terms. He has a deep guttural voice that is rarely used until after the sun has set, but from then on until a kill is made he will keep his mates posted of his whereabouts. When a Lion roars on a still, dark night, it brings a strange mixed feeling of awe and ad-

miration. There is the low deep grunt, repeated five or six times in succession, ending in an audible sigh, or the Lion may startle the forest with repeated resonant roars in quick succession, each increasing in volume until they die down in a low muffled gasp. When roaring the Lion has a habit of lowering its head toward the ground so that the sound seems to roll and reverberate in the distance.

Lions are nomads that follow the herds of game, spending most of the day resting in some thicket or under the shade of a tree. On one occasion I saw a Lion with a fine blond mane dozing out on the open plain, miles from shelter of any kind. When a Lion leaves its lair in the evening it usually roars, voicing its feeling at intervals well into the night. This, it is true, puts game on the alert, but it also makes it nervous and apt to betray itself. Once on the trail of its quarry, the Lion stalks in silence, walking on the tips of its toes (a characteristic of all cats). It treads lightly and leaves no spoor except on wet mud or soft sand. When the time approaches for real business, the Lion lashes its tail to and fro; but in the final charge, tail erect and stiff as a ramrod, with head lowered, it springs forward, uttering a series of deep terrifying growls. It comes in at a pace of not less than forty miles an hour from a distance of anything up to one hundred yards. A Lion seldom charges until it is sure of success and always approaches game from the side, rarely from the front.

The point of vantage aimed for is the neck. An experienced Lion will sink its teeth in this vital spot. Supporting itself with the extended claws of one paw hooked in the shoulder of the victim, the other paw reaches round the head and twists it back, throwing the animal to the

This elderly Lion was thin and obviously needed a good meal, so the author gave him a Warthog, which he soon dragged off.

Photo by the Author



ground, breaking its neck. In a matter of seconds all is over. Occasionally, a Lion will miss its mark, landing on the back of its intended victim, in which case the animal has a possible chance of escape. Some Lions have learned their technique so well that they can dislocate the neck of a victim with one blow of the paw and wait for it to fall.

Having killed, the Lion is joined in the feast by its mate, young or companions. On the Serengeti Plains I saw six male Lions that gratefully accepted a proffered antelope. They devoured all the animal but the larger bones, and except for seeing who could eat the fastest, there was no quarreling or display of bad temper. If it is a lone Lion that makes a kill, it will eat its fill and then stand guard over what remains against prowling Hyenas, Jackals, and, of course, Vultures that have seemingly appeared in force from nowhere, waiting on the tops of nearby trees.

In Africa, Lions probably kill more Wildebeest than any other game, but Zebra is their choice. Where Zebra abound, there will be Lions. They also kill large numbers of Waterbuck, Kudu, Impalla, Reedbuck and other antelopes. Occasionally, Lions kill Buffalo and Giraffe. They have been known to attack a Hippopotamus, three Lions rushing one of these animals that had strayed on dry land, and despite its hair-raising shrieks, holding on until they were dragged into the water and had to let go or drown. Lions will kill and eat Crocodiles when they catch them on shore, but Crocodiles also kill Lions when they go to drink.

There are Lions and Lions. Some scientists refer to them as a whole under the name *Leo*, others *Panthera* or just plain *Felis*. Of the different kinds of Lions, the Barbary Lion was first to be recognized by science. It was named *Felis leo* by the famous Swedish botanist Linnaeus in 1758. This Lion was hunted by ancient Egyptian spearsmen, but it had gone by the early 1920's. The Cape Lion was lost much earlier, about 1865, but there are other named kinds of Lions alive in Africa today. We find them listed under such names as the Congo Lion, the Kenya Lion, the Kruger and the Cameroon Lions, the Masai Lion, and the Nyanza and the Senegal Lions. The Asiatic Lion has all but disappeared — but more about it later. The difference between the

various Lions is only apparent to the expert. We are going to look at all the Lions in general as one species, which, as a matter of fact, they are.

Lions are noisiest just before and during mating. There is no fixed breeding season. Some are said to be monogamous while others, it is believed, are polygamous. On occasion, a Lion will assist the Lioness in feeding her cubs, but such fatherly interest may not always be common practice. A Lion often has to fight two or three aspiring males for a favorite Lioness. The victorious Lion and his new bride now go off together on a prolonged honeymoon. They may stay in seclusion two weeks or more and are so enamoured with each other that they give little thought to food, if they eat at all. At this time their behavior, especially that of the male, is on the dangerous side. They show their displeasure of human intrusion by compressing their ears and quick lashing of the tail. Such a couple I saw in east Africa resting in the shade of some tall trees. I quickly lost all desire to get a closer look at what was going on when the Lion drew back his lips in an angry snarl, displaying a formidable array of teeth.

The honeymoon over, the pair return to their regular routine life. About sixteen weeks later the cubs are born in a lair in the rocks or in a thicket. They weigh between two and three pounds each at first and are barred with dark stripes on the body and thickly spotted on the limbs. There may be two to four cubs in a family and occasionally as many as six.

The cubs usually open their eyes on about the sixth day but some do not see the light of day until they are nine days old. As the cubs grow older the markings on the limbs and body begin to fade and have all but disappeared in ten months. Occasionally, a Lion will retain some spots and lines on the limbs through life.

Lions have a long childhood and are dependent on the parents for at least one year. Cubs will follow their mother when not much bigger than a common alley cat. They begin to assist her in stalking game when three months old but the actual killing of big game must be done by the parents.

The baby canine teeth are not replaced by the adult teeth until the end of the first year and it would not be possible for the cubs to kill game

for themselves before this. They have a difficult time during teething and may die of starvation if separated from their parents during this critical period.

A Lion has a life expectancy of about twenty or twenty-five years and some have lived thirty years in zoological parks. Lions and Elephants are among the few animals that die of old age.

Lions have few enemies except man. Occasionally a Crocodile may seize a Lion when it comes to drink and drown the unfortunate beast in the water. Cow Elephants with calves will chase a Lion, but it has little difficulty in losing them in the bush.

There is a general belief that a Lion cannot or does not purr. As a matter of fact, a Lion can make a throaty rumbling sound but it does not actually purr like a common house cat. A Tiger can purr but only a happy contented animal on affectionate terms with its keeper will give a demonstration of this strange phenomenon. Personally, I have never been on such familiar terms with the big cat and there is little likelihood that anyone has ever tried to coax a wild Tiger to purr. Lee Crandall tells me that Tigers at the New York Zoological Park will oblige if urged by the right person.

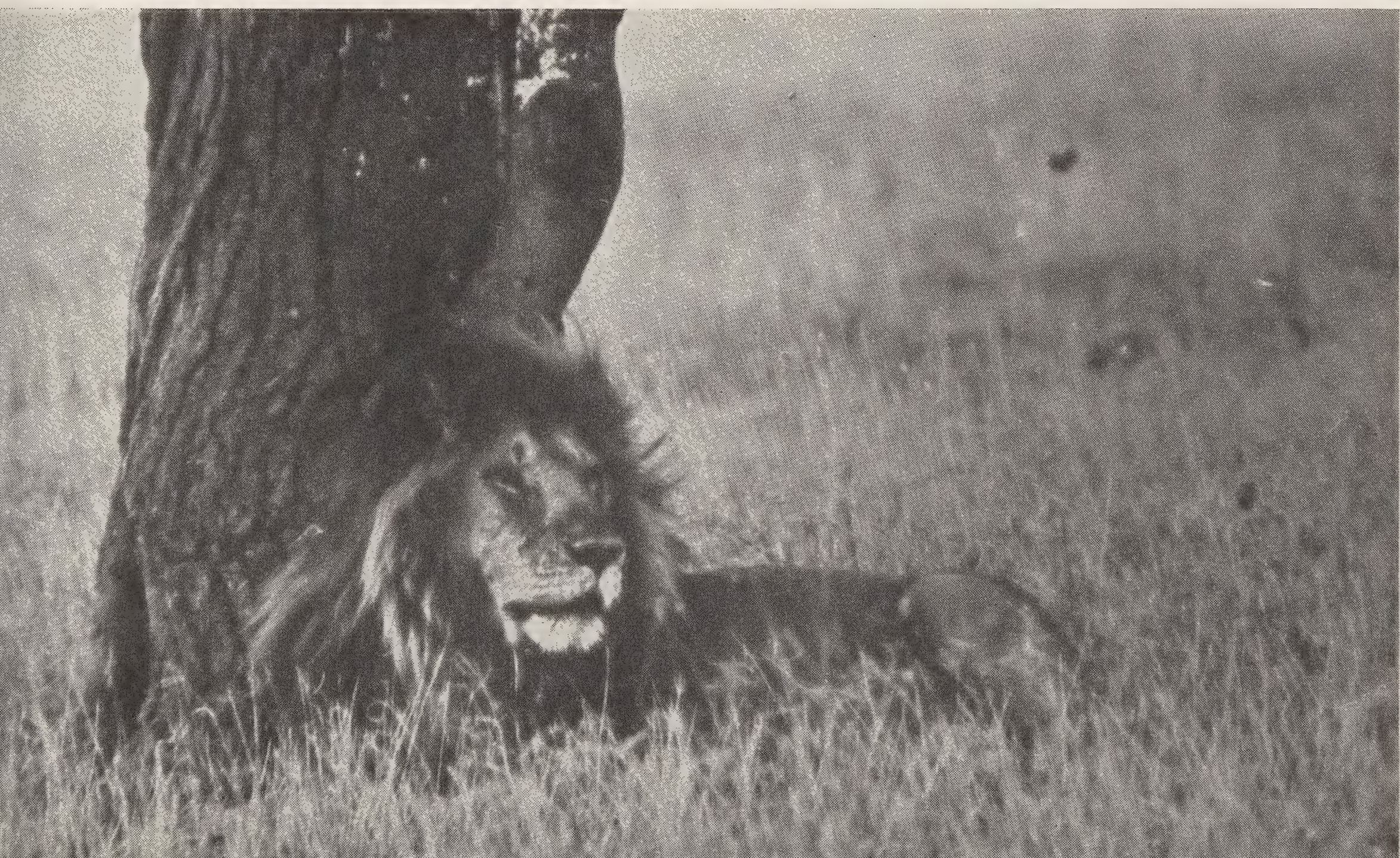
It is hard to believe that Lions can be, and often are, extremely dangerous animals, when one studies this black-maned old fellow. He seemed uninterested in anything except napping in the shade.

Photo by the Author

Usually Lions will retreat at the approach of man on foot or on horseback but they are intelligent enough to know when they are being hunted. Pursued, they are apt to turn suddenly and charge — attack being the best course of defense where man is concerned. A head-on rush is difficult to stop. Even though mortally wounded, a Lion may kill its pursuer before falling dead itself. Lion hunting is dangerous business. To be able to shoot accurately is not all that is necessary, though it is essential. One must understand Lions and know when and how to trek them.

One of the trophies sought by Lion hunters are the "lucky bones." These are rudimentary clavicles, small and shaped like a little battle-ax, and easily overlooked unless searched for in the right place. They are mounted with a gold clasp and worn as brooches.

As with people, there are Lions that become killers. Man-eating Lions are not necessarily aged individuals incapable of killing wild game that have turned to an easier prey in man. A man-eater is very crafty and usually silent. It is suspicious of man and his actions and never enters a camp or settlement until late in the night. Suddenly a man is seized and carried off at top speed into the shelter of the brush. The next attack will come from an entirely different direction or at a distant village. Man is not on the legal menu of the Lion. Man-eaters become so by virtue of circumstances or accident. It may be mistaken identity or in self defense that a



Lion kills a man. Once the spell of invincible man as a super-being has been broken, a Lion will kill again and again, matching its wits against man's superior intelligence.

Lions have killed more men in Africa than all the other kinds of dangerous game put together except perhaps the Crocodile. In 1898 two man-eaters of the Tsavo harassed the building of the Uganda railway for nearly nine months and succeeded in bringing the work on the railroad to a complete standstill for three weeks. During their reign of terror they killed and devoured twenty-eight coolies and a score of African natives. A third Lion not only killed several natives around a station but succeeded in seizing and carrying off the superintendent of the division. He had come to destroy the man-eater and his private car had been shunted onto a siding. Sitting by an open window waiting for the Lion to come, the superintendent apparently fell asleep and was himself carried off and eaten by his intended victim, which entered by the door.

In 1909 the ravages of a pair of man-eaters on Masai villages forced the natives to abandon the entire district until the Lions were killed.

Man-eaters are often very bold and daring, not easily deterred from their objective. One coolie, seized by a Lion and rescued though badly wounded, was taken a few hours later from his tent, but this time the Lion made off with the victim without interruption.

The behavior of a man-hunting Lion is very different from that of a Lion hunting game. A man-eater seems to realize thoroughly that it is trespassing on forbidden ground and has to cope with its most dangerous foe. A man-eater, once it has gained its victim, always makes a hasty retreat to a safe distance and, having fed, never returns to its ill-gotten gains. On the other hand, when a Lion kills a Zebra or some other game animal, it stays on the spot where the animal falls and makes no attempt to conceal its legal prey, first disemboweling it and often burying the offal nearby before feeding.

There are amusing incidents related to man-eaters. One seized and carried off the mattress from under a sleeping coolie. On another occasion, a Lion attacked a vender of pots and pans and got himself so tangled up in the vender's wares that he raced away, a much surprised Lion,

with jingling tins strung onto his legs and neck.

Lions swim well and often cross large rivers, but they are careful not to enter Crocodile-infested waters. They drink regularly between 6 and 9 p.m. and 3 and 6 a.m.

Females and cubs can climb trees and have been seen sunning themselves on the lower branches of large trees, but this is not a regular practice.

The Lion is closely related to the Tiger and the two big cats often cross-breed in captivity. A hybrid between a male Lion and a female Tiger is known as a Liger; vice-versa, the hybrid is called a Tigon. Usually Ligers and Tigons have some stripes and occasionally a mane when grown.

Africa is the ancestral home of the Lion — not the deep forest, nor the burning desert wastes nor the wet swamps, but the countless miles of veldt. It is only on the open plains and broken brush country stocked with teeming herds of big game that we find Lions in large numbers. Practically the whole of Africa except the western and central heavily forested areas once was Lion country, from the coastal plains up to 9,000 feet in the mountains. With the appearance of Europeans and the introduction of firearms, the Lion soon vanished from most of south and north Africa.

The Lion invaded Asia through Arabia and spread through Asia Minor to western Europe, leaving fossil remains in England. Cave drawings of Lions made by early man in France and Germany are unmistakable proof that it was there in Neolithic times. These seem to have been maneless Lions, for it is hardly likely that the master artists of that day would omit such an important character as a mane in their pictures, if the Lion had one. From historical records we learn that the Lion still existed in Macedonia at the time of the invasion of Greece by Xerxes. It was common in Palestine during early Biblical times, being referred to fifty times in the Old Testament. It has long since ceased to exist in these localities but continued in Persia and Mesopotamia until fairly recent times.

The Lion made a comparatively late arrival in India. It travelled there by way of Persia and Baluchistan, but did not reach Ceylon before the island was severed from the mainland, nor did it extend its range into the southern peninsula at any time.

The region now known as northern India was Tiger country that had been occupied by this big striped cat for many centuries. If there was any question as to who was the king of beasts, it must have been settled there and then. India apparently pleased the big tawny cat, as it settled down, took over the country in force and held it until the arrival of the Europeans. The chances are that the Tiger stuck closer to its domain in the forest while the Lion hunted on the open plains, causing no open conflict between the two biggest cats.

At the time of the British occupation, Lions were common throughout northern India from Sind in the west to Bengal in the east. However, handsome rewards offered by the government for the destruction of Lions, combined with the love of the creature for open country, soon put the Asiatic Lion on the brink of extinction. During the Mutiny an English officer alone shot 300 Lions, 50 of them in the neighborhood of Delhi. Since this was not considered unusual it gives a vivid picture of their former abundance in India. The survivors of the once mighty Asiatic Lion are now restricted to the Gir Forest in Kathiawar — an area of about five hundred square miles set aside as a sanctuary. In recent years their num-

bers have been placed at between 70 and 80 animals. There may be 200 there now.

The so-called maneless Lion of Gujerat has often been used as an explanation of the fact that wild animals rarely have large manes. Thorn bushes, it is claimed, keep dragging out the mane as fast as it grows, until no mane is left. True enough, this particular Lion did live in thorn bush country, but the most the thorns could achieve would be to keep the mane well groomed. The name, however, was originally used only in comparison with the heavily-maned Lions seen in zoological parks and was not intended to convey the idea that the animal had no mane at all.

An African Lion led the procession of foreign wild animals exhibited in America. Its first appearance here was announced in the Boston Gazette of September 26, 1720. President Andrew Jackson was somewhat embarrassed by the presentation of a Lion by the Emperor of Morocco. Following the advice of Congress, he sold the animal at auction and gave the proceeds, \$3,350, to local orphanages. Today, Lions breed so readily in captivity, and are so common, that Zoos sometimes have had trouble giving them away to other Zoos.

NEWS FROM THE CONSERVATION FOUNDATION

Resources for the Future Holds Princeton Conference

Resources for the Future, a subsidiary organization of the Ford Foundation which was set up to conduct the activities of the Foundation in the resources field, held meetings of its officers and directors at the Princeton Inn, Princeton, New Jersey, on June 18 to 20. President Fairfield Osborn, one of the directors of R.F.F., attended all the sessions and reports that a most constructive program was conducted. One of the purposes of the meeting was the indoctrination of Dr. Reuben G. Gustavson, the new president of Resources for the Future, who has resigned the Chancellorship of the University of Nebraska in order to associate himself with this new group.

Film on Marine Resources Is Being Considered

The making of a motion picture tentatively titled "The Living Ocean" or "Yours is the Sea" has been discussed in a preliminary way with Admiral Edward H. Smith of the Woods Hole Oceanographic Institute, the Admiral having suggested a collaboration of his organization and the Audio-Visual department of the Conservation Foundation for the production of such a film. There is some indication that the Institute is prepared to make a sizable contribution to such a project, and the project itself has many things to commend it. Such a picture would round out the scope of this Foundation's film program most satisfactorily.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

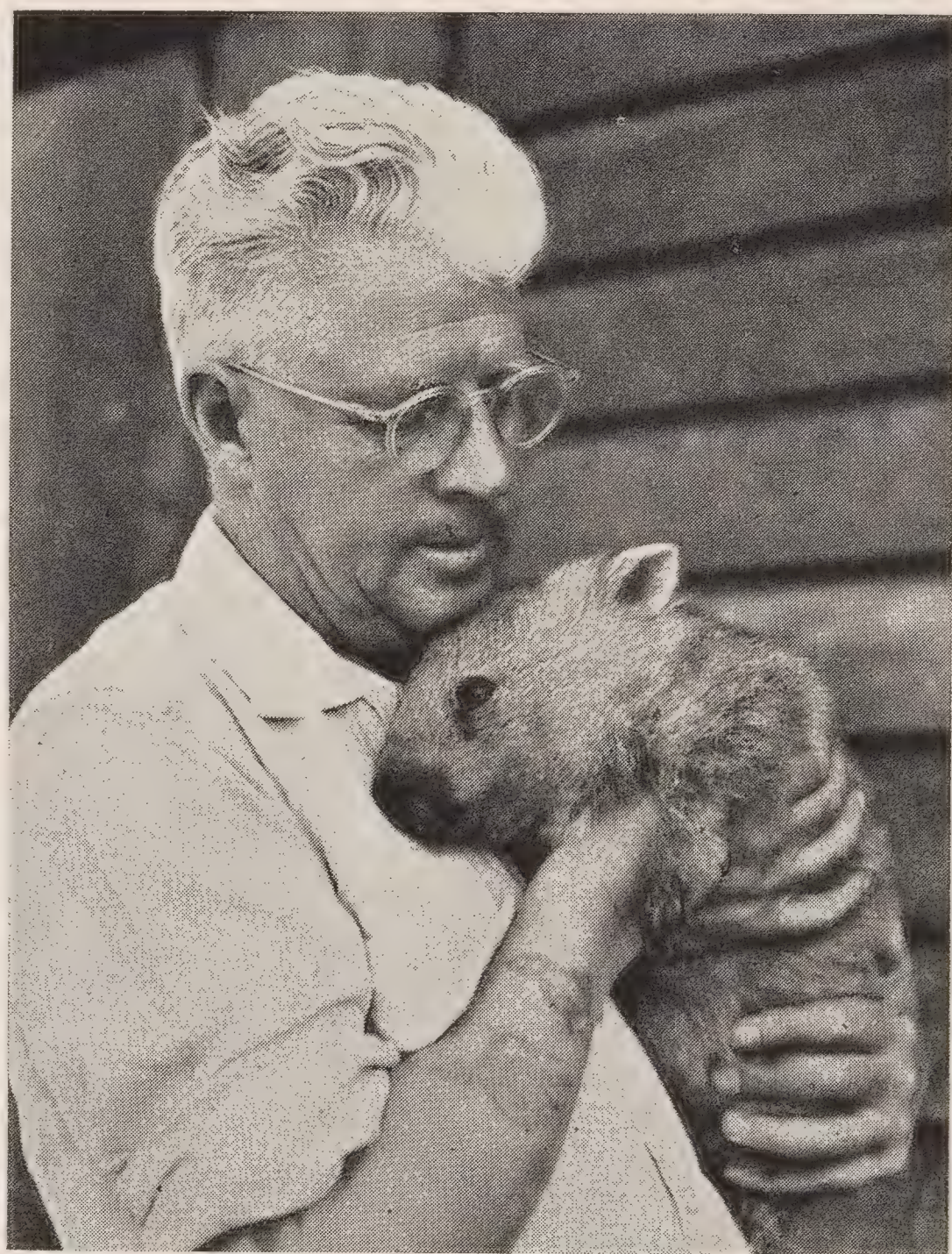
Peter the Second Is Off to a Lively Start

When Peter the Great, our gentle Hippopotamus, died on February 1 after setting a world's record for longevity, we *hoped* that we would be able to get a Peter the Second before too many months. The opportunity came unexpectedly soon and on Thursday, July 2, early in the afternoon, Peter the Second arrived.

He is a fat, healthy, lively, friendly and destructive baby weighing 259 pounds on arrival and probably he is just under a year old. All we know about his background is that he was shipped out of Nairobi earlier this year and spent a short time in the Milan Zoo on the way to the United States. According to report he is about 13 months old, but his weight would indicate considerably less than that. A Hippopotamus born in the Philadelphia Zoo was estimated to weigh 60 pounds at birth, and two others born there were 605 and 655 pounds, respectively, at 18 months. So — unless Peter the Second is woefully undernourished, which he doesn't seem to be — he should be no more than nine or ten months old, at the most.

Although he is perfectly tame, Peter wrecked the glass front of his temporary compartment in the Elephant House within half an hour after he arrived. The excitement of being liberated from his shipping box was apparently too much for him. He raced around the compartment, reared on his hind legs against the glass front — which had been sufficiently stout to hold a whole family of much larger Pigmy Hippopotamuses — and the glass gave way. Peter was not injured, but he had to be barred out of that part of his home until the glass could be replaced by heavy boards and wire. Extra tin shields had to be installed in the corner of his compartment to keep him from climbing out, too.

We lay it all to the excitement of new surroundings and confidently expect that Peter the Second will be as tractable over the years as his illustrious predecessor. After all, Peter the Great rebelled at being moved from the Antelope House to the Elephant House in 1907 and had to be dragged into his moving crate by main strength.



George Scott and Friend

On his way to New Guinea after Birds of Paradise, our Headkeeper of Birds visited David Fleay, who brought our Platypuses in 1947. At Fleay's Fauna Reserve near Brisbane Mr. Scott was photographed with a friendly Wombat. Mr. Scott returned to the United States with a magnificent collection just before we went to press. The birds will be reported on in detail in the September-October issue of this magazine.



Peter the Second is now at home in the Elephant House. This was the first time he had seen his yard, but he was less interested in his surroundings than in the food that lured him out.

There is a possibility that this fall we will be able to get a young female Hippopotamus as a companion to Peter the Second. Peter the Great never saw another Hippopotamus from the day he left his mother until he died at the age of 49 years, 5 months and 19 days. We intend to do better by Peter the Second.

Duckbill Platypuses Are Making Zoological History

After we had given up all hope of inducing our Duckbill Platypuses to breed, they showed typical symptoms of mating behavior on Sunday, June 21, and we are now waiting to see if the female, having constructed a nest and presumably laid eggs, actually produces the first baby Duckbills ever seen outside of Australia.

Three previous attempts in the past two years to further "romance" by leaving the animals together in seclusion resulted in nothing but signs of annoyance on the part of Penelope, the female.

This summer the animals have been kept separate and were exhibited at different hours, but on June 21 Penelope, at the close of her exhibition hour, scratched vigorously at the barrier separating her from Cecil. She was admitted, and that evening the two spent much time swimming in circles with Cecil holding on to Penelope's tail — one of the typical "courtship" gestures. Other signs of courtship followed, and then Penelope industriously excavated the earth from a hard-packed bank at the end of her burrow. In early July she fed unusually heavily for a few days and later carried underground the eucalyptus leaves provided by the New York Botanical Garden — eucalyptus being customarily used by Platypuses in Australia to line their nests.

The incubation period seems to be between 7 and 10 days. At the time *ANIMAL KINGDOM* went to press, Penelope had remained in her burrow for five days and nights, as she was expected to do if she were incubating.

PUBLICATIONS OF INTEREST

EYES IN THE NIGHT. By Bengt Berg. Pp. 164, illus. 57, in black and white, from photographs. Translated into English by Lynette Jarbo and published by Dietrich Reimer, Berlin, 1952. Price DM 11.50.

Since only one of this well-known nature writer's previous books has appeared in English, this charming volume is particularly welcome. It has to do with the bird and animal life of one of those wild, rocky islands that line the Baltic coast of Sweden. Principally, it deals with the intimate family life of the Giant Eagle Owl, gargantuan relative of our own Horned Owls, and with the adventures of a young bird reared by hand. Interspersed are numerous references to other furred and feathered residents of the island. Apparently little has been lost through Miss Jarbo's excellent translation and Dr. Berg's humorous presentation and obvious antipathy toward sentimentalism have been carefully preserved.

The photographs are really good and typical of the fine work for which Dr. Berg is noted. — L. S. C.

POSSUMS. By Carl G. Hartman. Illustrated with numerous black and white drawings. Pp. xiii + 174. University of Texas Press, Austin, Texas, 1952. \$6.00.

That a scientist of Dr. Hartman's status can produce a book of such charm and readability and at the same time so packed with historical and technical information, is a heartening indication of changing times. Too

often, in the effort to present factual material on general reader level, the literary impulse tends to overlie truths. "Possums" is outstanding proof that fact and pleasant presentation are not incompatible.

Following a most interesting account of the Opossum by early explorers and zoologists, the life history of this curious marsupial mammal is presented. This culminates in what is really the nub of the matter: the means by which the embryonic infant enters its mother's pouch. Long a point of doubt and controversy, the question was finally answered by Dr. Hartman, who, in 1920, first saw and described in detail the almost incredible journey of the new-born morsel, entirely under its own power, to the haven where its development is to be completed. The absorbing interest of this fact, together with parallel material concerning the marsupials of Australia, is so deftly handled that it becomes completely absorbing.

After passing this center of greatest interest, the reader may pass on lightly to 'possum poetry,' possum folk-lore and possum recipes. There is even a quotation which sums up neatly, without offense to the animal psychologist, a very sound opinion as to the intelligence of this lowly creature:

"'Possum up a 'simmon tree
'Possum don't know nuffin'."

An elaborate bibliography and an excellent index complete a book which will take its place with the biological classics. — L.S.C.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1953)

Founder

Saul Blickman

Patron

Mrs. John Jay Whitehead

Contributing

Henry V. Bischel

Edward C. Brewster

Miss Janet Zaph Briggs

H. Clifford Brown

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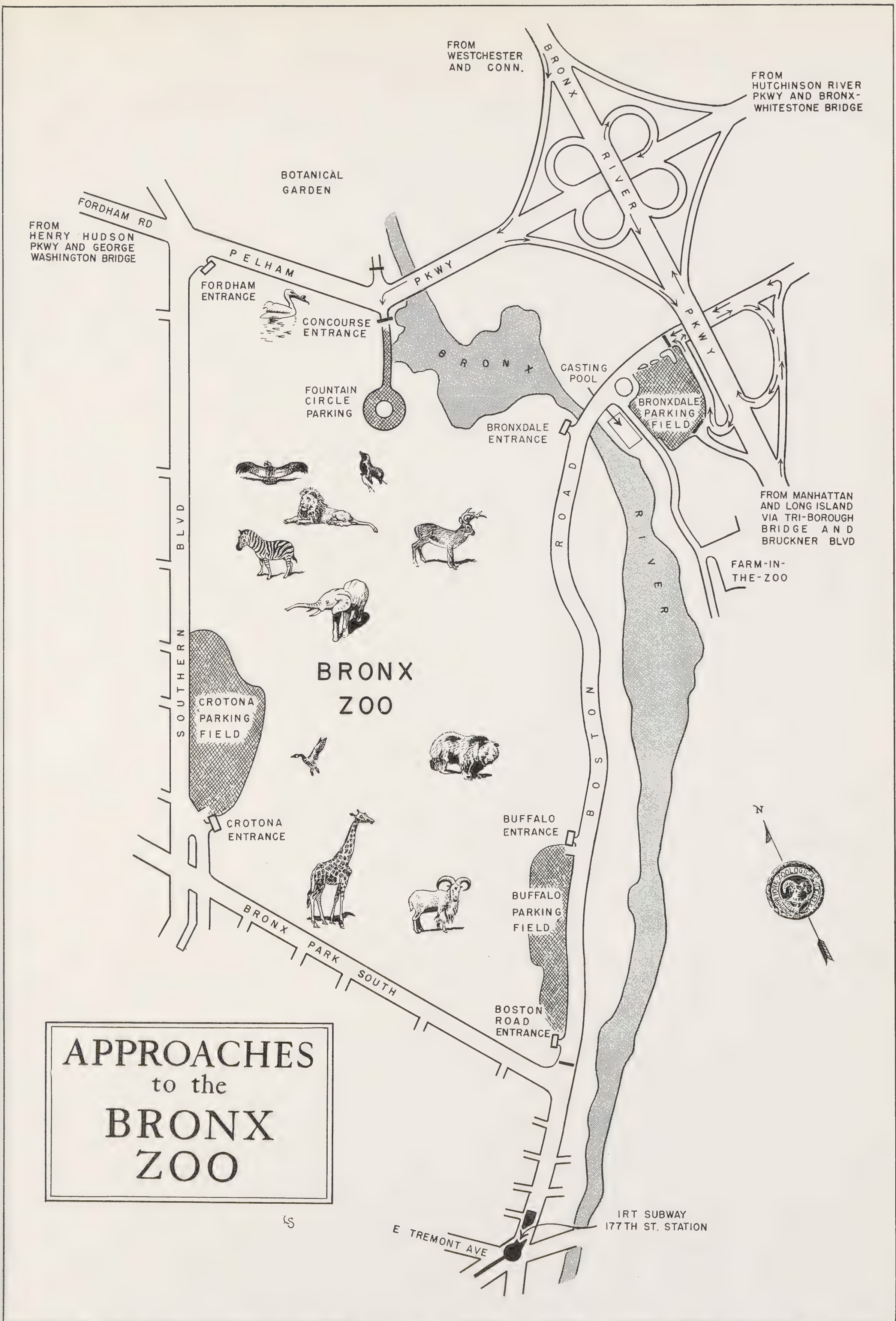
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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LVI OCTOBER 1953 No. 5

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Ethereal Trumpeters

DISTANT AND ALONE, near the Continental Divide in northwestern Wyoming, lies a lake nestled under a towering rock escarpment known as Hawk's Rest. This is a mother-region of rivers, birthplace of the Yellowstone and the Thoroughfare. Spring comes in June and winter is born in October. Man comes rarely for the lake lies a long trail-ride, thirty miles or more, from the nearest highway or even primitive road. It is not a large lake, as lakes go — maybe half a mile long and about as wide. Of course there are many such exquisite little bodies of water in that faraway mountain region but this one is especially distinguished because it is a chosen resting place of the Trumpeter Swan.

The eye and spirit are rewarded by the sight of these snowy-white creatures — majestic they are, the largest waterfowl in the world. Once they may have flown their aerial mountain pathways in companies of hundreds or even thousands but this is pure speculation because the records of their early abundance are questionable. Today we know only too well — they are on the borderline of survival. Merely some five hundred in all remain in our own country, with perhaps a somewhat larger number in the more northerly waterways in Canada. However, it is good to know that efforts for their protection in recent years are aiding them and their numbers are actually increasing. All they ask is to be left alone — it is not much! How greatly we need to endeavor and to hope that they shall not disappear from the earth.

For several days in late August we camped by "Swan Lake." Already there was the first restlessness of autumn in wind and sky. Overnight the mountaintops would be brushed with fresh snow, no whiter than the swans who now and again, effortlessly, would fly from one lake-corner to another, lifted by wings that spread eight feet from tip to tip. In the dead of night, from the depths of our heavy sleep, we would hear their trumpeting. And so we think of them as the "ethereal trumpeters."

Fairfield Osborn



Head-dresses of Bird of Paradise feathers are treasured heirlooms in New Guinea tribes. The men at left and right have plumes of the rare King of Saxony's thrust through their noses.

(Photographs by the Author)

ROUND TRIP TO NEW GUINEA

By GEORGE SCOTT

Head Keeper of Birds

EXACTLY a quarter of a century ago I came very near being sent to New Guinea as a field assistant to General Curator Emeritus Crandall, then Curator of Birds, when he was making his great expedition for Birds of Paradise. Now I have just returned from my own expedition to New Guinea to bring back the Birds of Paradise that Sir Edward Hallstrom presented to the Zoos of San Diego, St. Louis, Chicago and New York, and what a difference a quarter of a century has made!

It took Mr. Crandall seven months by boat and afoot. I left New York on April 25 and returned on July 14, just a little more than 11 weeks out and back. Mr. Crandall had to find and catch his own birds, of course, while mine were already caught and waiting for me. But even so, the airplane has made a tremendous difference in zoological collecting. The ruggedness has gone out of a round trip to New Guinea for Birds of Paradise. A good thing, too, for I am twenty-five years older than I was a quarter of a century ago.

Mr. Crandall has agreed to write about the actual birds I brought back, so here I shall give only a sort of diary of the journey as a way of providing a "setting" for these jewels of our Bird House. They are spectacular in themselves, but if you know a little about the place they came from I think you can appreciate them more.

THE WAY IT IS NOWADAYS, you leave New York International Airport at breakfast time on Saturday and the next Wednesday you have breakfast in Sydney (having sacrificed a day on the International Date Line along the way). My breakfast in Sydney was not as happy as it might

have been, because all my baggage had been left in Honolulu.

In the week of waiting that had to be endured before a plane left Sydney for Nondugl, the station in the Wahgi Valley of New Guinea where the Birds of Paradise were being kept for my arrival, there was barely time to do the minimum things that a bird man would want to do on his first trip to Australia. My eyes began popping that first day in Sydney when Sir Edward led me into an inner office that I can only describe as a little private museum of Birds of Paradise — mounted birds, of course, but you don't soon forget your first sight of even a mounted King of Saxony's with its long, swooping crest-feathers, or the Ribbon-tailed with even longer white plumes.

Back in 1928 Mr. Crandall's guide and companion on his Bird of Paradise expedition was John E. "Pop" Ward, now 87 years old and still living at Balmain on the outskirts of Sydney. Talking to him, I learned what a Bird of Paradise expedition was like in the old days, for it was Pop Ward who brought the first Blue Bird of Paradise out of New Guinea in 1920. There are still cannibals in New Guinea — or would-be cannibals — but they are under strict control. It wasn't so then. White men occasionally did disappear into a village pot. Once Pop was invited and even urged by a group of natives to visit their village. Their insistence made him suspicious and he refused to go. Later he found out that he was to have been the main dish at a feast.

I hated to say "so long" to this grand old man whose name will always be associated with fabulous exploits in the field of New Guinea ornithology. He walked down to the ferry with me,

and the last I saw of him was when he was trudging up the hill, head down, body bent forward, just as he must have looked climbing Mt. Kabena on his Blue Bird of Paradise quest.

I won't even try to describe the Taronga Zoological Park where Sir Edward took me a couple of days later. But I shan't soon forget an Empress of Germany's Bird of Paradise and 16 Blue Manucodes flitting about together in one cage — or a round dozen Lawes' and Carola's Birds of Paradise in another. Quantities of Magnificents, Greateres, Superbs, Salvadoris — all the great names in Bird of Paradise lore!

There was just time for a two-day trip down to Queensland to see another old friend of the Zoological Society, David Fleay, the "Platypus Man," who brought our Cecil, Penelope and Betty in 1947. In the past couple of years they have established their own prosperous and fascinating wildlife park at Tallebudgera Creek, West Burleigh, just outside Brisbane. David has a tame Platypus named Teddy that loves to be played with, and all sorts of animals are a part of the family — a Wombat and a Barking Owl, for instance. While I was there somebody brought in a baby Pademelon Wallaby which the Fleays took in stride. Their daughter, Rosemary, made an artificial pouch and put the tiny creature to bed after giving it a good feed from a bottle.

The week of waiting for a plane finally came to an end and in a matter of hours we were in Port Moresby — definitely in New Guinea where the Birds of Paradise come from. In 1928 Port Moresby had been Mr. Crandall's jumping-off place; the Papuan Hotel the actual center where his expedition got together. It is still there, its face lifted and modernized a bit, perhaps, but still the Papuan Hotel. I was glad that our plane was grounded because of storms over the Owen Stanley Mountains so that I got to spend the night in that hotel where the Zoological Society's other Bird of Paradise expedition had started.

You get into the remoter part of New Guinea by stages, one plane seldom connecting directly with another. Impatient as I was to get on to Nondugl and see our birds, I was pleased to have a stop at Lae, for that is Bird of Paradise country, too, and it gave me a chance to get into condition. An old chap I met in Lae runs a sawmill eight miles out of the town and he often saw

Birds of Paradise around the mill. The only way to get out there is by taxi, so I hired a taxi and went Bird of Paradise hunting in luxury. Hunting is all I did, though. The manager of the mill sent one of his native boys out into the bush with me as a guide, but the boy knew very little about where to look, and I knew less. It was rough going; the boy had to hack a path every foot of the way and of course our noise would have frightened every bird in the neighborhood. Probably it was too late in the day, anyway. Nevertheless I could hear Birds of Paradise calling, even though I couldn't see them. Nothing to see except parrots and fruit pigeons and bee-eaters — all of them birds that would have thrilled me if I hadn't been intent on the great prizes.

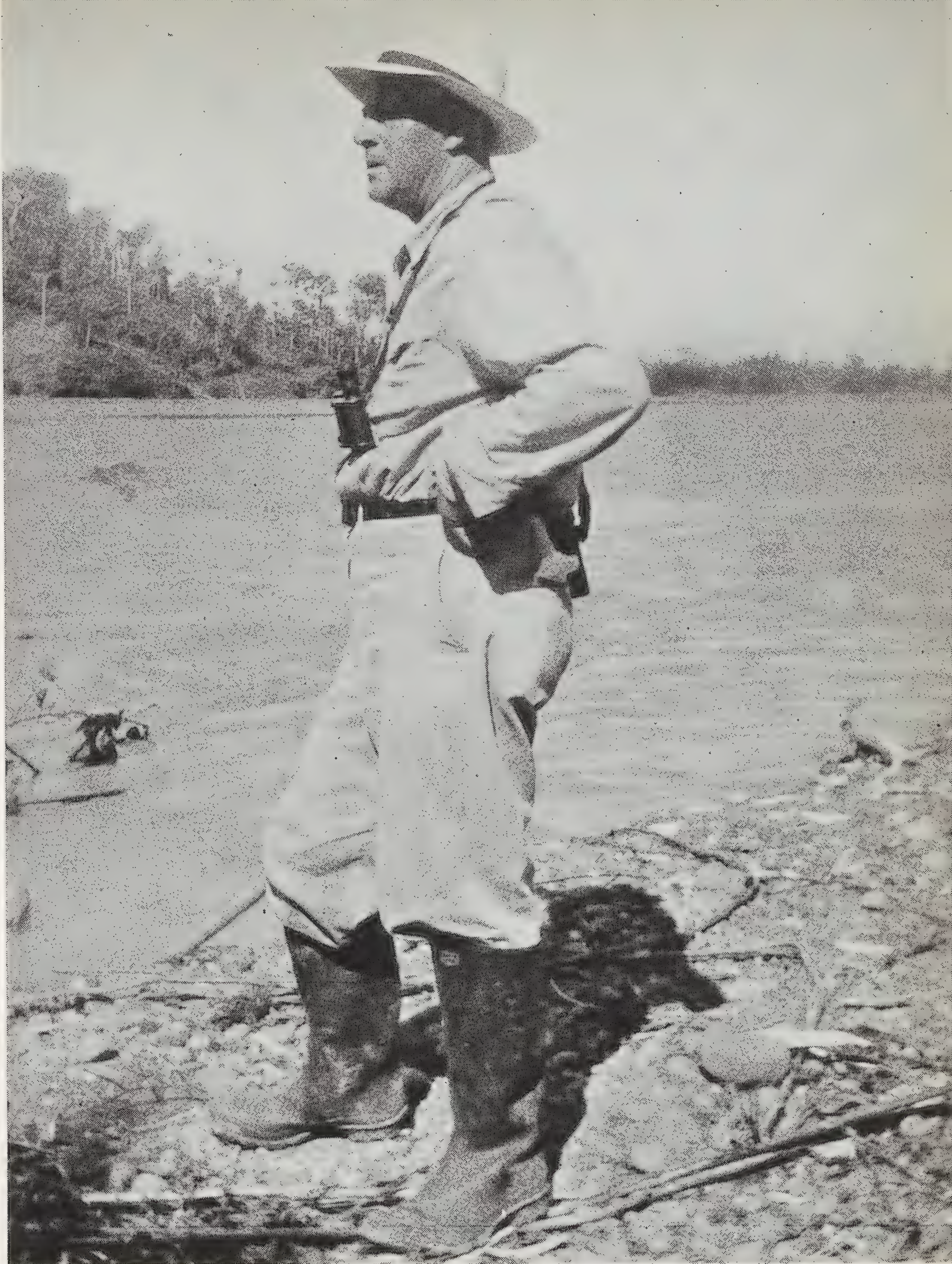
Thomas Gilliard, the ornithologist who is now working at the American Museum of Natural History in New York and who discovered and named Margaret's Blue Bird of Paradise, had visited that exact area and the mill people had pointed out to him some birds that must have been Count Raggi's or Count Salvadori's.

Well, I didn't see any Birds of Paradise, but I had heard them, and that was getting nearer and making it all more real. That night I crept home dead tired, for I had been walking for several hours through thick brush, with gum boots on.

On Wednesday, May 15, I went out to the Lae Airport ready to take the plane to Nondugl. Naturally, it was grounded — I began to feel as if I were never going to get to that valley station where my birds were waiting. The trouble is that New Guinea mountains are high and tricky, and unless there is perfect visibility the pilots are not allowed to fly over them. Sometimes they're grounded for days on end. It turned out all right, though, for we left the next morning.

I knew that Bird of Paradise plumes are common ornaments of the natives in these parts, but up to now I had been in the more civilized areas and I hadn't see any. That was soon remedied, for at the plane's first stop, at Garoka, my eye fell on an impressive figure in the crowd of half-naked natives that surrounded the plane. It was a Baiyer River chief with a plume of the Six-plumed Bird of Paradise thrust through a hole in his nose. He stood out even more spectacularly because he was wearing a head-dress of Lesser Superb and Stephanie tail feathers.

ae Mr. Scott went scouting for
s of Paradise by taxi and then
t. He reached the Markham River
re he heard several birds calling.



Baiyer River itself was the next stop, and there New Guinea showed itself in the raw — really the raw. Hundreds of natives swarmed around, some of them to help unload the plane and others just to see the white men. They backed away when I stepped out. My white hair frightened them, I was told. However, they soon got over that.

Quite a number of women in the crowd seemed to have mutilated hands. The tips of their fingers were cut off. That was a mystery until I learned that cutting the ends of your fingers off is a sign of mourning — and not only for a member of the family. The death of a favorite pig or dog is an excuse for chopping your fingers off, too. One woman had the ends of

three fingers removed on one hand, and two on another. She must have had an epidemic in her family or her livestock. It seems that when they get ready to put on mourning, they give themselves a sharp whack on the elbow with a hatchet, to numb the arm temporarily, and then go to work on the fingers. Afterwards they dip their hands in cold charcoal, and the following day pack them in clay. They almost never get infections.

Each stop of the plane took us deeper into New Guinea — a matter of only a few minutes' flying time, but of many days if you were afoot. Civilization moved backward in about the same proportion. At Hagen every native face was painted and most of the men wore shells in their



noses. Benze was the same, and then, in a mere half hour, we came to a smooth landing on the airstrip at Nondugl — the end of the long road that started at the Bronx Zoo.

THE WAHGI VALLEY is a broad, flat plateau at 5,500 feet elevation, and Sir Edward's agricultural station at Nondugl is one of the few spots inhabited by white people. Mountains ring it around and clouds drift across their summits and roll down the heavily forested sides. It is, I should think, a kind of primitive paradise; the

earth is fertile and all sorts of crops from coffee to corn, beans and tomatoes grow quickly and well. As, indeed, they should, with a daytime temperature of 70 to 80 degrees and adequate rainfall.

Barry Osborn, the Station manager, and Fred Shaw Mayer made me welcome. I could hardly wait to look at the collection that Shaw Mayer had formed, some of which I was to take home. There it was, in neat screened cages with palm-thatch shelters: Ribbon-tails, Salvadoris, Mayr's Gorgetted, the Golden-crowned Six-plumed,

Finschs, Long-tailed, Blues, Kings, Magnificents, MacGregors, all in splendid condition — as any collection of Shaw Mayer's would be, of course — and almost all of them either species or subspecies I had never seen before.

I stayed in Nondugl for six weeks, from May 14 to June 29, for it took that long to work out all the complicated schedules for getting me and the birds back to the United States by air. My diary for the period is full of references to "sing-sings" that I attended at one place or another, and it would seem that I was having a continual holiday. Actually the sing-sings, or native dances, were

Permanent aviaries for Birds of Paradise have been established at the station at Nondugl. Our birds were not here until Mr. Scott arrived.

Waiting to leave Nondugl — 82 boxes, each containing one bird. They are fierce fighters and if shipped together would soon kill each other.

highly incidental, for I had a busy six weeks. I soon took over the care of the collection in order to learn the peculiarities of individual birds, their food requirements and the problems I would have to solve on the way back.

Obviously there were a lot of Birds of Paradise in the area. At one sing-sing I went to with Sir Edward — who came out to spend a little time at the station — there were some 300 natives and every man wore plumes. I figured that 1,500 to 2,000 Birds of Paradise contributed their skins to the colorfulness of that dance. Collecting live Birds of Paradise by white men is strictly regulated under permit, but the natives can kill with bow and arrow all they want for ornament. They kill only adult birds, seven years old or older, for it is only then that the plumes are at their best.

One man wore the plumes of fourteen Count Salvadori's Bird of Paradise. Plenty of them were decorated with the lovely plumes of the King of Saxony's which nobody has ever seen alive outside of New Guinea and Australia.

These sing-sings are, I suppose, wonderful "re-





On June 29 an airplane arrived at Nondugl and Mr. Scott was ready to start for home with his precious cargo. Although he travelled by air, he was more than two weeks en route.

laxation" for the natives, but I would find them pretty monotonous. They go on for months, and not much gets done in the fields or anywhere else while a sing-sing is going on. It's a chance for everyone to show off his wealth of feather decoration and even a little sing-sing brings out a fortune in Bird of Paradise plumes.

As a result of this demand for plumes, the birds have been pretty well cleaned out of some regions. As a matter of fact, while Sir Edward and I were at one sing-sing, a Lululi, or chief, came up to Sir Edward and asked if he would sell some of the birds in his collection there at Nondugl! When a New Guinea native wants to buy

Birds of Paradise from a white man, that's news!

The number of Birds of Paradise in New Guinea must be really tremendous, for this plume-wearing has been going on for a long, long time, and it's still possible to see the birds even on casual walks. For instance, I walked to the village of Bambna, a few miles from Nondugl, heard a Bird of Paradise calling, and soon spotted it — a Count Salvadori's — in a native garden. He was displaying in a tree and nobody except myself was paying any attention. The next day I took another walk and at an hour's distance from Nondugl I saw three Count Salvadori's in one tree, one of them dancing. Naturally I was excited and thought I would do some collecting on my own, but nobody in the village was interested in snaring them. I had no equipment myself, so I had to pass them up. But it was a hard thing to walk away and leave three Salvadoris.

Actually, if permits could have been arranged, I would have gone into the bush with a party of natives in search of more Ribbon-tails for the collection, but it couldn't be done.

So, caring for the collection by day, paying visits to the handful of white people in the valley and occasionally going to a sing-sing to look regretfully at the Bird of Paradise plumes bobbing on the heads of the dancers, I passed the weeks while transportation was being arranged.

On June 29 everything was cleared and at 4:30 o'clock in the afternoon everything was loaded on the plane and I said good-bye to Nondugl. I don't suppose I shall ever see that story-book valley again, but it is a good place to remember. Surely there are few such Edens left in the world today.

The next two weeks I would rather not remember, for the most part, for they were largely filled with worries about airplanes — would they come, or wouldn't they? — about the effect of the heat on the birds, and about supplies of food for the collection. The route home was one of constant stops and layovers: Nondugl, Medang, Manus (in the Admiralties), Guam, Wake, Midway, Honolulu, Los Angeles, San Diego, back to Los Angeles, Albuquerque, Kansas City, St. Louis, Chicago and at last New York in the evening of July 14.

Manus toughened me to the return journey, however. There was supposed to be a quick plane connection out of there, but word was waiting that the plane would be along "sometime between July 1 and 6." And I had just enough fresh pawpaw to feed until I got to Guam.

Wing Commander Coombs was most helpful there at Manus. He gave me a whole hangar for the birds — it was the coolest spot on the island. There wasn't much fruit, even pawpaw, to be had, but the Wing Commander sent a soldier out in a jeep to round up what he could for me. Fortunately it was enough, because I was thinking of sending a radio back to New Guinea to have a plane pick me up and take me back to Nondugl to wait until transportation out of Manus was assured.

What complicated things all the more was that everybody on Manus was worried about a volcano some twenty miles away. They had been watching it working up to an explosion, and if a

real one came they figured the resulting tidal wave would come right across the island. In fact, they were making plans to evacuate the island. But I had no time to worry about volcanoes, for the MacGregors were feeling the heat pretty bad. Every few minutes I had to turn their cages this way and that, to catch any tiny stray breeze.

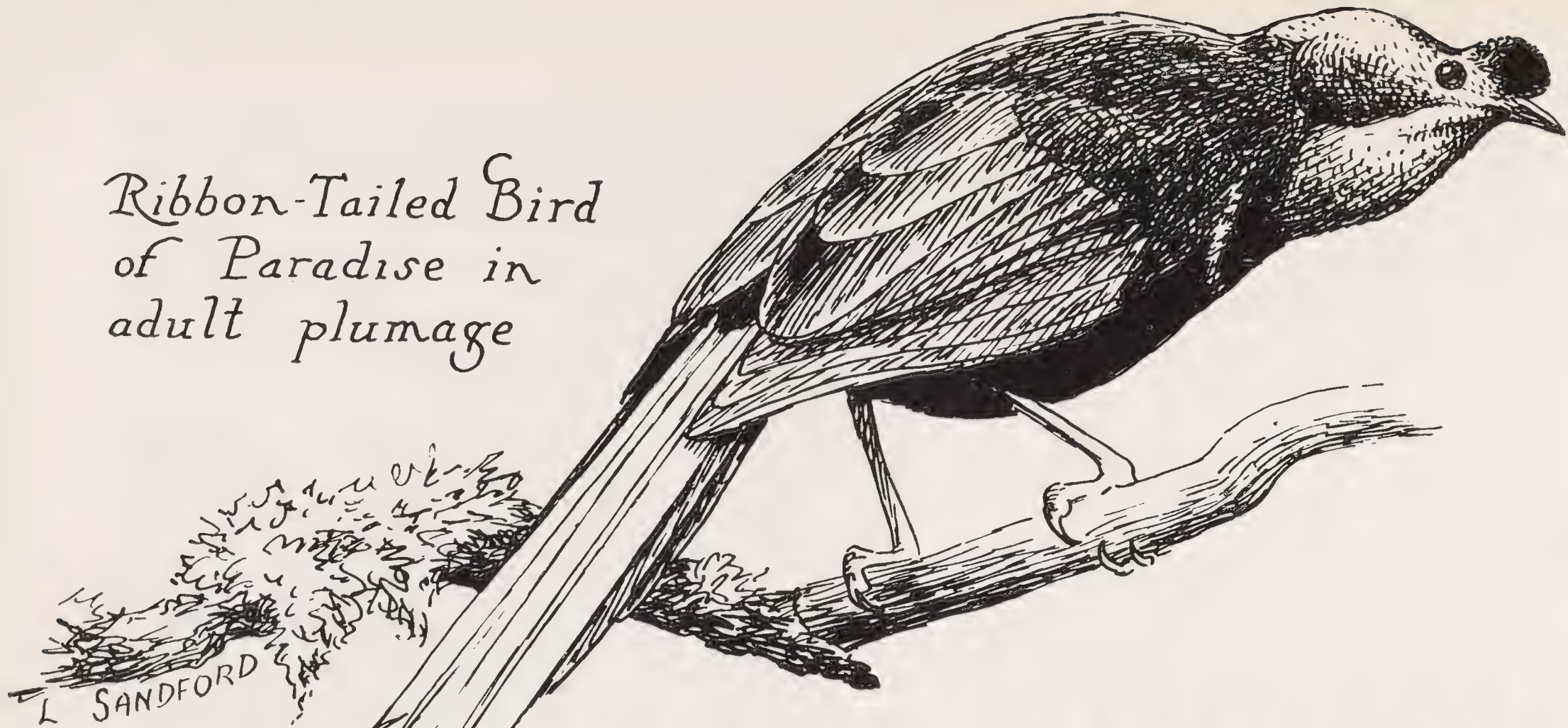
When it finally came time to leave on July 5, the plane that was to carry us to Guam had been standing in the sun for several hours and was roasting hot inside. People could stand it, but not birds. Well, just to show how accommodating people can be when you're really in trouble — the pilot took off, climbed up two or three miles until the plane was good and cool, and landed right in time for me to load and get going.

Each stop had its own, and different, problems. At Guam, for instance, the Department of Agriculture inspectors wouldn't let me carry any fruit on to Wake and Honolulu to feed the birds. So I stayed up all night stuffing them, so they would be well-filled before we set out. The birds slept most of the trip, as they certainly should have after that feeding. I stayed awake and worried, but I didn't need to, because Honolulu Zoo was only one brief stop away and there Director Paul Breese and a well-trained staff were expecting me, had plenty of food in readiness, and took over while I relaxed for the first time in weeks.

I left four birds with Mr. Breese, as Sir Edward had promised him, and the rest of the trip home was an easy slide downhill. Mrs. Belle Benchley of the San Diego Zoo met the plane at Los Angeles and again a crew of experts took over, trucked the whole lot down to San Diego and rested them — and me — for three days. Nineteen specimens stayed in San Diego, nineteen more in St. Louis, nineteen more in Chicago, and on the night of July 14 we unloaded the remaining nineteen at New York International Airport where just about every member of the Zoological Park staff was waiting to get a look at them.

In the spring of 1929 I had gone down to the pier at Gowanus Creek to meet Mr. Crandall's boat when he came back from his New Guinea expedition. He was out at the airport to meet me on this summer night in 1953. I told everybody how glad I was to be back with all the birds alive and well, but I expect only Mr. Crandall really knew how deeply I meant it.

Ribbon-Tailed Bird
of Paradise in
adult plumage



A GIFT WORTH WAITING FOR

By LEE S. CRANDALL

General Curator Emeritus

GEORGE SCOTT'S successful enterprise, engagingly recounted in this issue of *ANIMAL KINGDOM*, was the culmination of three years of planning and hoping. When E. G. Hallstrom (now Sir Edward), Chairman of the Taronga Park Zoological Trust of Sydney, Australia, visited New York in 1950, he brought to the American Museum of Natural History its first mounted specimen of the beautiful Ribbon-tailed Bird of Paradise, most recently discovered member of this fabulous family. During a luncheon in his honor at the Zoological Park, he promised that a gift of living Birds of Paradise would be sent us at the first opportunity. At that time there seemed to be no obstacle, for the aviaries at Taronga Park and those of Sir Edward's private installations were teeming with birds, supplied from the collecting grounds near Sir Edward's great agricultural experiment station at Nondugl in the mountains of northeastern New Guinea. However, governmental regulations, enacted for the laudable purpose of protecting the Australian poultry industry from possible introduction of epidemic diseases, soon barred the importation of further Birds of Paradise from New Guinea. Since there was no hope of replacement, shipment of birds already in Australia was obviously impossible.

Since there is no established means for direct transportation from New Guinea to the United States, special arrangements had to be made. The infinite details of planning undertaken by Sir Edward, the efforts of Fred Shaw Mayer, well known as the leading collector of Birds of Paradise, to gather and hold the birds, and the skill and determination of George Scott have culminated in a result well beyond reasonable expectation.

On July 14, 1953, the following Birds of Paradise, representing our share of the collection, arrived at the Idlewild Airport:

NEW GUINEA COLLECTION

JULY 14, 1953

- * 2 MARGARET'S BLUE BIRD OF PARADISE, *Paradisaea rudolphi margaritae* Mayr & Gilliard
Wahgi Valley, Central Highlands,
eastern New Guinea
- ** 3 FINSCH'S BIRD OF PARADISE, *Paradisaea minor finschi* Meyer
Northeastern New Guinea
- 1 COUNT SALVADORI'S BIRD OF PARADISE, *Paradisaea apoda salvadorii* Mayr & Rand
Eastern New Guinea
- * 2 GOLDEN-WINGED MAGNIFICENT BIRD OF PARADISE, *Diphyllodes magnificus chrysopterus* Elliott
Japan Island and northern New Guinea
- * 1 GOLDEN-CROWNED SIX-PLUMED BIRD OF PARADISE, *Parotia carolae chrysenia* Stresemann
Sepik Mountains, northern New Guinea
- ** 1 BLOOD'S LONG-TAILED BIRD OF PARADISE, *Epimachus meyeri bloodi* Mayr & Gilliard
Mt. Hagen, northeastern New Guinea
- ** 3 MAYR'S GORGETTED BIRD OF PARADISE, *Astrapia stephaniae ducalis* Mayr
Herzog Mountains, eastern New Guinea
- ** 1 MACGREGOR'S BIRD OF PARADISE, *Cnemophilus macgregorii* DeVis
Mountains of southeastern New Guinea

- ** 2 STRESEMANN'S KING BIRD OF PARADISE, *Cicinnurus regius similis* Stresemann
Northern New Guinea from Ramu River to
Humboldt Bay
- *** 1 RIBBON-TAILED BIRD OF PARADISE, *Astrapia mayeri* Stonor
Mountains of north central New Guinea, in
Hagen-Sepik District
- 1 MACKLOT PITTA, *Pitta erythrogaster macklotii* Temminck
W. Papuan Islands, W. & S. New Guinea,
Cape York and N. Queensland
- * 1 NEW GUINEA BARN OWL, *Tyto tenebricosa arfaki* (Schlegel)
New Guinea

* New to us.

** New to United States.

*** New to exhibition except in Australia.

The great prize of the collection is the Ribbon-tailed Bird of Paradise. Our specimen is in moult now, but the yard-long, white plumes that give it its name should begin to show by October 15, and by mid-winter should be full.



Seventeen Birds of Paradise of ten forms, all named and listed — prosaic enough. But there is more to this naming than appears at first glance. For of the ten, nine were new to us and of the nine, only four had English names, which immediately brought up a weighty and controversial point. During recent years a trend has been developed among naturalists writing for general consumption, toward the use of a common name for all forms of a species, regardless of how much

without prejudice to their general views!) they freely joined in the search for vernacular names. So that is how Margaret's Blue Bird of Paradise (named for Mrs. Gilliard), the Golden-crowned Six-plumed, Blood's Long-tailed, Mayr's Gorgetted and Stresemann's King acquired their English designations. Very often we have performed this service for birds of lesser stature and have done so without compunction. But Birds of Paradise are not to be so lightly treated.



they may differ from each other. Thus, yellow-plumed, orange-plumed and red-plumed subspecies of *Paradisaea apoda* are all called Greater Birds of Paradise! Since the situation plainly called for consultation, we sought the collaboration of two members of the ornithological staff of the American Museum of Natural History — Mr. E. Thomas Gilliard, who is personally familiar with the Nondugl area, and Dr. Dean Amadon, an experienced systematist. Readily admitting the difficulties of our position as exhibitors (but

The Golden-winged Magnificent Bird of Paradise is as spectacular as its name would indicate. Our bird is in its full adult plumage. It is a form that we have never before exhibited.

No one in the United States has previously exhibited MacGregor's Bird of Paradise. Although it is not on sight here, the bird has a curious brown crest atop its golden head.

Much could be written about all or any of these wonderful birds — the shimmering beauty of the Blue, the curious white flank feathering of the Golden-crowned Six-plumed, the brilliance of the scarlet, green and white of the little King, the mysteries, yet to unfold, of the bright orange MacGregor's. But the story of the Ribbon-tail, from its beginning in 1939, is so filled with romance as well as with the intricacies of nomenclatural procedure that it outshines all the others.

Still another form that is new to us is the Golden-crowned Six-plumed with its half-dozen tabbed "wires." Some were damaged in transit, but they will be replaced at the moult.

For some years, tales had been recounted of an unknown Bird of Paradise with long white tail feathers living in the Hagen Mountains of north-eastern New Guinea. A pair of these narrow white ribbons was finally secured by Fred Shaw Mayer and sent to C. R. Stonor at the British Museum (Natural History). On the strength of these two feathers, Stonor (1939) assigned the



name *Astrapia mayeri* to the new species. Later in the same year complete skins of three males were sent to the Australian Museum and fully described, with a colored plate, by J. R. Kinghorn (1939), under the name *Taeniaparaedisea macnicolli*. Further confounding the issue, Ernst Mayr (1941) came to the reasonable conclusion that since only the male of the new bird had been collected, it must represent the cock of *Astrapia feminina*, a species described in 1922 from females only, collected a few miles northwest of the Hagens. Soon afterward, however, true fe-



male Ribbon-tails markedly different from those of *feminina* were secured, thus invalidating Mayr's designation. So, after fourteen stormy years, Stonor's name *Astrapia mayeri*, since it ante-dates Kinghorn's, stands for the Ribbon-tail and the missing male of *feminina* continues to defy detection in the remote fastnesses of the great Sepik Range.

Somehow it seems suitable that the discovery of a species of such striking beauty should have resulted in turmoil. For this is no ordinary bird: its velvet-black plumage is variegated with iridescent blue-green on head and throat and there is the usual burnished copper pectoral band common to the genus. Features of variation are the large nasal feather tuft and a corresponding smaller one at the base of the lower mandible. But most curious of all are the two pointed, black-tipped white central tail feathers, very narrow and surprisingly stiff, reaching a maximum length of approximately thirty-six inches. It seems remarkable that a bird so striking could have remained so long unknown.

Facilitated by a small landing field almost at the base of Mt. Hagen, the efforts of Fred Shaw Mayer and Capt. N. B. Blood, at that time station manager at Nondugl, to secure the Ribbon-tail alive soon resulted in a fine series at the Taronga Park Zoo, at Sir Edward's private aviary and at Nondugl. But George Scott's two birds, one each for the Zoological Parks of Chicago and New York, are the first to be seen alive elsewhere.

Since our first Birds of Paradise—three Greater cocks—were received in 1910, we have now exhibited thirty-seven of the approximately ninety recognized forms of the family Paradisaeidae. This superb addition stands to the credit of the kindly spirit of Sir Edward Hallstrom and the devotion of Head Keeper George Scott.

REFERENCES

- Stonor, C. R. 1939 (Feb.). Bull. Brit. Orn. Club, 59: 57.
 Kinghorn, J. R. 1939 (Dec.). Aust. Zoologist, 9: 295-296.
 Mayr, Ernst. 1941. List of New Guinea birds. Am. Mus. Nat. Hist., N. Y., p. 172.

Margaret's Blue Bird of Paradise is an immature male, not yet in the full glory of its electric blue and shining black plumage. The subspecies is new to the Bronx Zoo collection.

The Album of Peter the Second

PHOTOGRAPHS BY SAM DUNTON

WHEN OUR FIRST HIPPOPOTAMUS came to us on July 14, 1906, it never occurred to anyone that the events of his early days in the Zoo would be of interest almost half a century later — of special interest because the little animal was destined to set a world's record for Hippopotamus longevity.

We aim to be more aware of the potentialities of Peter the Second. If he does as well as his predecessor, sometime around the year 2000 the members of the Zoological Society will be interested to look back at the album of baby pictures

on this and the next two pages, and to know that the by-then-patriarchal Pete was once a fat, always hungry, always good-natured favorite of the Zoo. From time to time, although not always for publication in *ANIMAL KINGDOM*, we intend to record his exploits and growth photographically. Right at the moment we are trying to find a very young female Hippopotamus who will, through the years, share a compartment in the Elephant House with Peter the Second. Our former large Hippopotamus compartment is being remodelled to accommodate two animals.



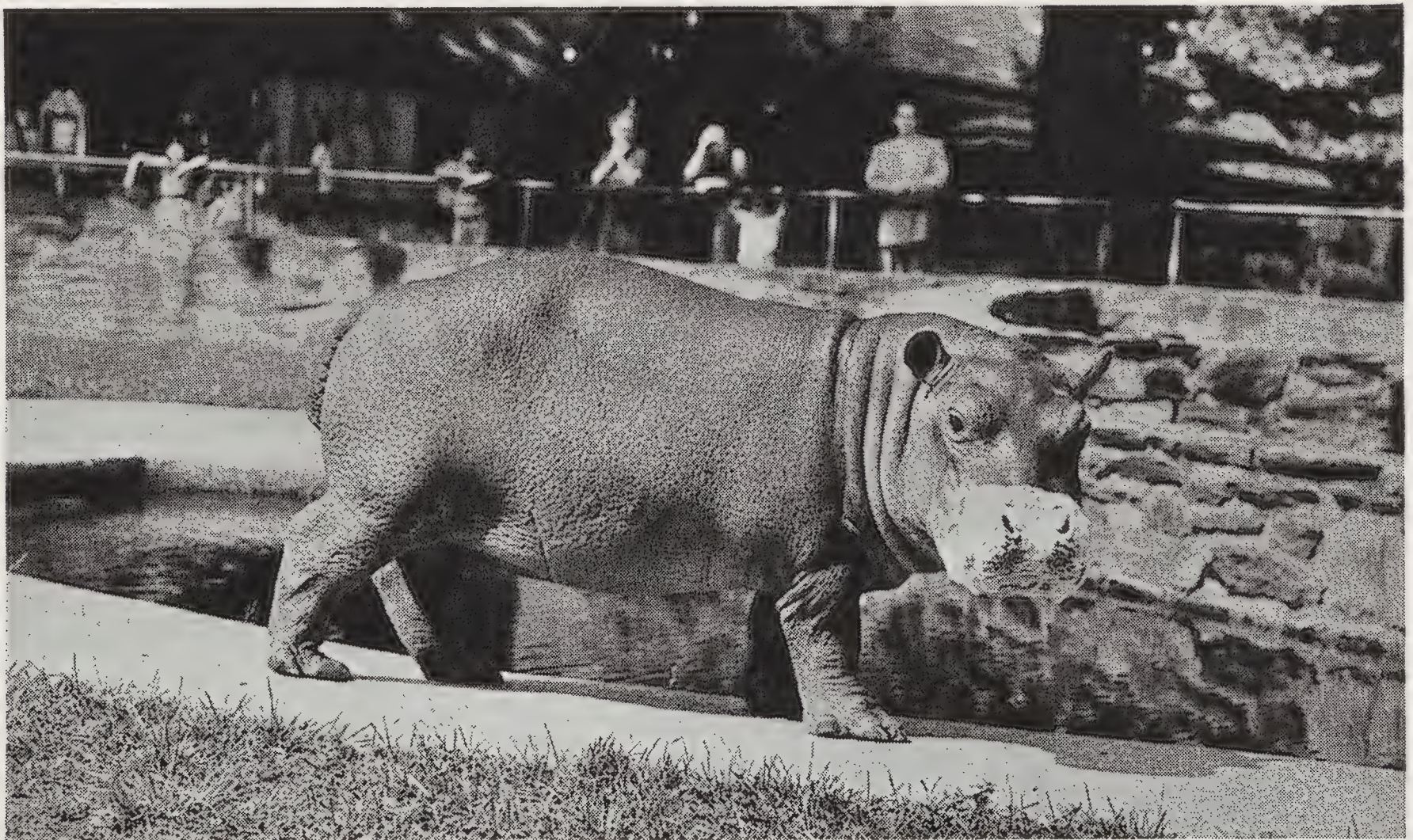
A minor amount of wheedling by Keeper Richard Herdick induces Little Pete to go into the yard.

By carefully maneuvering a bowl of food, Pete can be posed anywhere. He is always ready to



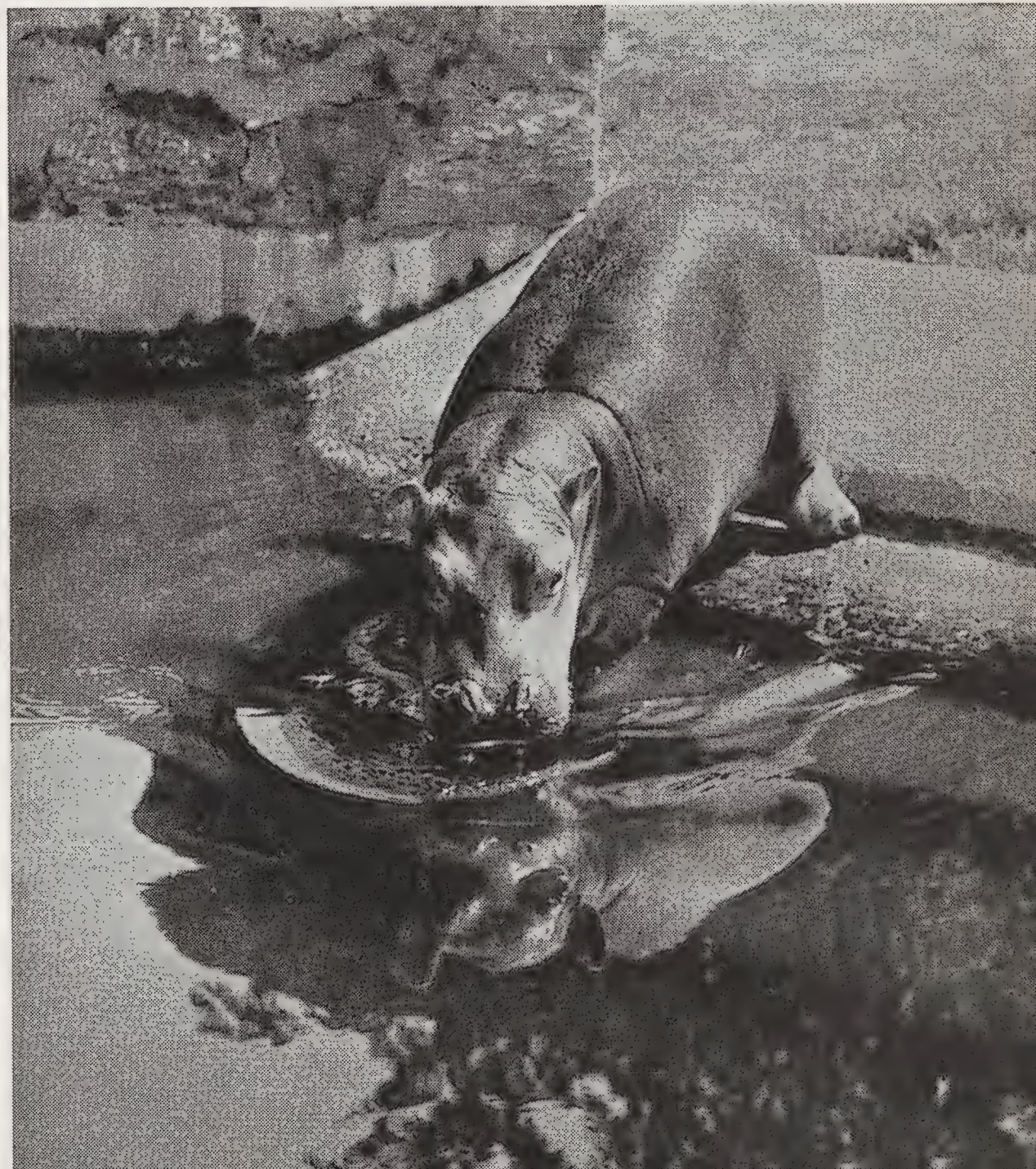


One of Pete's five meals a day is composed of milk and Pablum. And very little of it is wasted.



A bath after the morning meal is not only pleasant — it is also a practical way of washing the face.

Pete spends a great deal of his time in the pool, out of sight. It is his only really bad habit.





If we have a baby Platypus, this is the way it should have looked about mid-September. This is Corry, the baby hatched by David Fleay's pair in Australia, at the age of about 8½ weeks.

It Seems to be Good—

THE OUTLOOK FOR A BABY PLATYPUS

By ROBERT M. MCCLUNG

WHEN DAVID FLEAY brought three Platypuses from Australia to the New York Zoological Park on April 25, 1947, the big question in everyone's mind was, "Can Platypuses be kept successfully in America?" The only other living Platypus ever seen in America was a specimen brought to the Park in 1922, which survived for only 47 days. This time, however, the Platypuses flourished, and the answer was an emphatic "Yes." Although the smaller of the two females died of pneumonia in the fall of 1948, Cecil and Penelope have been with us for more than six years, during which time they have thrived under the watchful care of Platypus Keeper John Blair.

Once we found out that we could keep Platypuses successfully, we wondered if Cecil and Penelope might breed. Only one Platypus had ever been bred and reared in captivity. After years of trying, experimenting and hoping, David Fleay had been successful in 1943 in breeding his pair, Jack and Jill, at the Healesville Sanctuary in Australia. Jill subsequently nested and raised a female youngster, Corry.

Fleay had shown that it could be done. In 1951^{1,2} and again in 1952³ we attempted to follow suite with Cecil and Penelope, but with no success.

¹ *The Platypus — A Good Try.* Lee S. Crandall, *Animal Kingdom*, Nov.-Dec., 1951, p. 172.

² *More Details on Cecil and Penelope.* John Blair, *Animal Kingdom*, Jan.-Feb., 1952, p. 23.

³ *No Platypus Eggs.* *Animal Kingdom*, July-Aug., 1952, p. 134.

Of course there were many problems. In Australia the Platypus breeding season extends from August through October, which is springtime in the southern hemisphere. We did not know whether our Platypuses would breed during these months or would reverse their seasons in the northern hemisphere and breed in our springtime. From their schedule of molting, indications were that Cecil and Penelope had reversed their seasons. Instead of shedding their hair in January and February, as they do in Australia, our pair customarily start to shed in August.⁴ We tried in both spring and autumn to breed Cecil and Penelope, but Penelope did not seem to be interested.

This year we decided against another try, for there seemed to be little likelihood of success and another attempt would mean keeping the animals off exhibition again during the summer. On May 8 we moved Cecil and Penelope into their summer quarters in the out-of-doors Platypusary and began to exhibit them almost immediately.

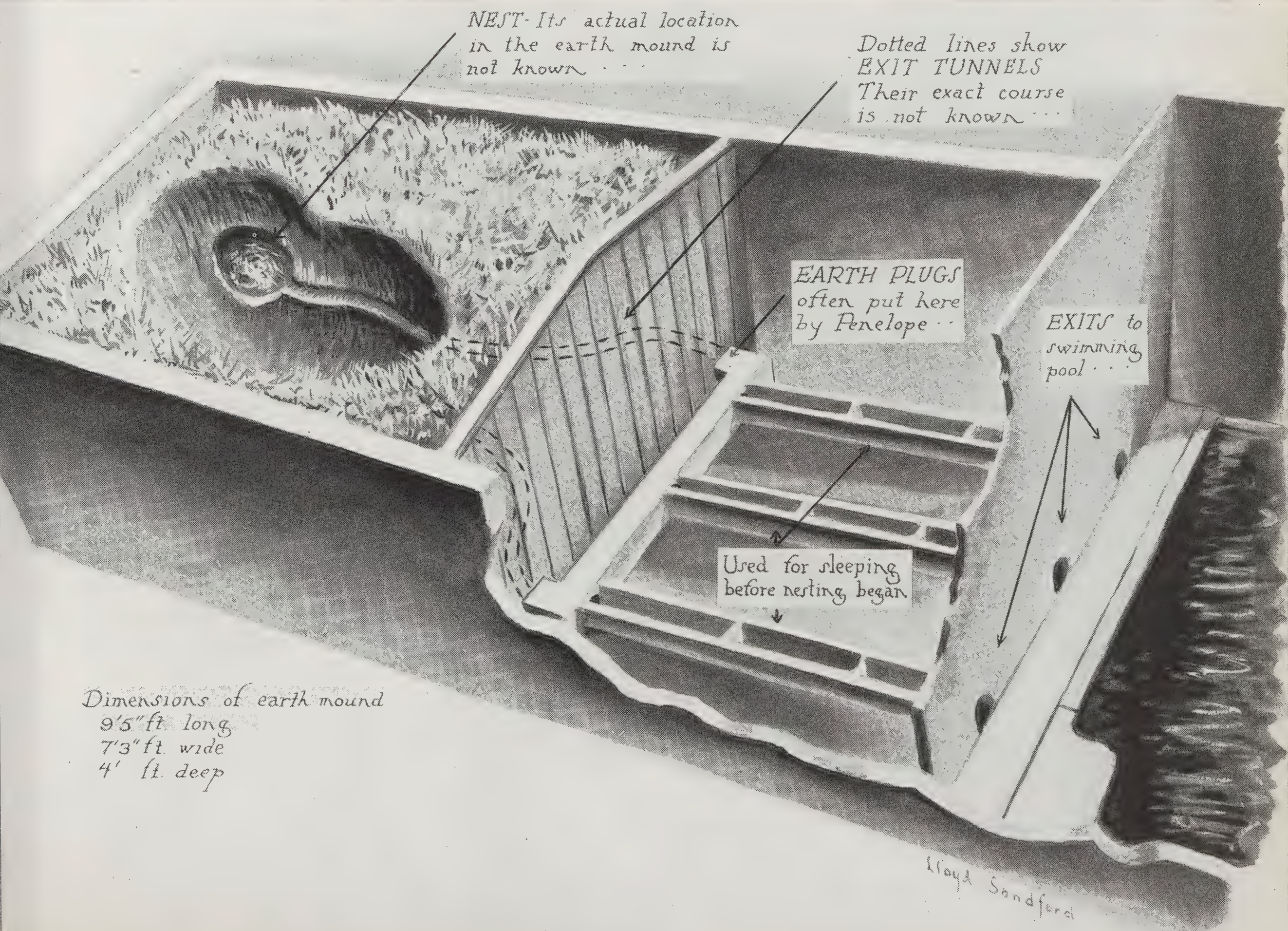
Then, on June 21, we got a surprise. At the end of Penelope's exhibition period that day,

⁴ *Our Duckbills Moults by "American Time."* John P. Blair, *Animal Kingdom*, Sept.-Oct., 1952, p. 163.

Keeper Blair noticed that she scratched vigorously at the partition between her pool and Cecil's instead of returning immediately to her own burrows, as she customarily did. Blair removed the barrier between the two sections of the pool and the Platypuses immediately started courtship activities. Cecil seized Penelope's tail and the two slowly swam in circles. Cecil alternated this behavior by preening and nuzzling Penelope, who seemed to be responsive. It was the first such activity that had ever been noted between the two.

Courtship continued for three days. Actual mating was not observed, but from subsequent developments we suppose it took place in that period. On June 26 Penelope was given access to her clay bank, which had not been open to her before, and she promptly began digging in it that night. Beginning June 28 dried Eucalyptus leaves, obtained from the New York Botanical

Somewhere in the mound of earth that is part of our out-of-doors Platypusary, Penelope has her nesting burrow. We will not know details until the mound is opened at cold weather time.



Dimensions of earth mound
9'5" ft. long
7'3" ft. wide
4' ft. deep

Garden, were placed in her pool daily for use in nest-building.

The situation looked promising, to say the least, and everyone concerned began to read and reread "We Breed the Platypus," David Fleay's excellent account of his Jill's successful breeding activities in 1943. Penelope, however, was blithely unaware of our intense interest. She dug in the clay bank nightly, ate heartily and ignored the Eucalyptus leaves. Cecil, meanwhile, had been separated from her on June 27 because she showed signs of disturbance at his presence and also because we wanted to check on her food consumption. He has been in isolation ever since except on the night of July 2 when we decided to provide another opportunity for mating if it had not actually occurred before.

By July 6 it had been 16 days since the beginning of courtship and Penelope had shown no interest in building a nest. Night after night she ignored the Eucalyptus leaves and our hopes began to wane. Then on the night of July 6, all the leaves were taken — approximately 40 of them. On the night of July 7 we put a double portion of leaves in her tank. These in turn were gone the next morning. On July 8, all of our remaining stock of dried Eucalyptus leaves went into her pool, as well as some dried grass, dried maple leaves and a few fresh Eucalyptus leaves which we had secured that day. The next morning, except for the grass and fresh leaves, this material was taken, too. Undoubtedly, Penelope was building an underground leaf-padded nest, and from the amount of leaves taken, it was a bulky one.

As long as things were going so well, we were willing to provide leaves and another pile of them was supplied on the evening of July 9. But the next morning they were untouched, and so was Penelope's food. She had not been out in her pool at all. Had she retired to lay and incubate eggs? Her behavior certainly paralleled that of Mr. Fleay's Platypus and indicated that she had.

For 7 days and 6 nights — from July 9 to 15 — there was no sign of Penelope in her pool. Night after night went by, and she remained somewhere inside the clay bank. We hoped she was curled up around one, two, or possibly three round eggs, in her nest. The press, which loves stories about romance, babies and animals, had a field day with this story, which combined all three, with an added element of mystery. Day after day the papers popped the Platypus questions with interest and vigor in such picturesque headlines as:

"Zoo Wonders; Is Penelope Mother?"

"Is There Or Is There Ain't A New Platypus at Bronx Zoo?"

"Penelope Yields To Cecil's Charms"

"Platypus Blessed Event Indicated"

So far, Penelope had paralleled Jill's 1943 activities very closely, except that she had taken 3 days to complete a nest, while Jill built hers in 24 hours. That, however, could be explained by the limited daily supply of Eucalyptus leaves we had been able to give her. The question was — would Penelope *continue* to parallel Jill's activities? The chart below gives a comparative summary of the behavior of both Jill and Penelope, up to the time this is written.

JILL (Data taken from "We Breed the Platypus" by David Fleay)	PENELOPE
<i>Mating</i> September, 1943. Courtship observed several times from mid-September on. Oct. 11. First true act of mating observed at 3:30 P.M. during heavy rainstorm.	<i>Mating</i> June 21, 1953. Penelope and Cecil observed in courtship after 3:00 P.M. during heavy rain. Courtship behavior continued for 3 days.
<i>Male Separated on October 18</i> Jill feeding ravenously. No interest shown in nest-building.	<i>Male Separated on June 27</i> (Cecil put with Penelope again for 1 night, on July 2). Penelope eating more than usual, June 28 to 30. No interest shown in nest-building.
<i>Nest-Building</i> Oct. 23. Jill took dried Eucalyptus leaves from pool into her clay bank, for nest. Started leaf-gathering at 3:30 P.M. Finished that night.	<i>Nest-building</i> July 6, 7 & 8. On each of these nights Penelope took all the dried Eucalyptus leaves into her clay bank.

1-6	Oct. 25 - 30. Jill retired into her clay bank at 7:00 P.M. for incubation period. She did not reappear in her pool until Oct. 31.	July 9 - 14. Penelope retired into her clay bank, presumably for incubation. Did not reappear in her pool until night of July 15.
7	Oct. 31. Out briefly in early morning. No food eaten. Animal not seen.	July 15. Penelope was definitely out tonight, although she was not seen. Eight crayfish eaten.
8	Nov. 1. Observed from 2-2:30 P.M. Furpreening and scratching at mammary area.	July 16. Out during the night. Ate 17 crayfish.
9	Nov. 2. Not seen out.	July 17. Seen in pool at 8:30 P.M. No preening observed. Ate 20 crayfish, no worms.
10	Nov. 3. Out between 1:00 A.M. and dawn. Not seen. Extremely little evidence of feeding.	July 18. Out during the night. Not observed. Ate 21 crayfish.
11		July 19. Seen in pool at 8:00 P.M. Ate 30 crayfish.
12		July 20. Out at night but not seen. Ate 22 crayfish, no worms.
13	Nov. 6. Out between 11-11:45 A.M. Exercising a great deal. Ate a few small crayfish and earthworms.	July 21. Seen in pool at 8:30 P.M. Ate 16 crayfish, no worms.
14	Nov. 7. Seen out from 5 to 5:45 P.M. Swimming, feeding and scratching mammary area.	July 22. Out at night. Ate about 20 crayfish.
15		July 23. Out at night. Ate 49 crayfish — a marked increase.
16 - 21	Nov. 9 - 14. Out daily in late afternoon and early evening. Feeding vigorously.	July 24-29. Out each night. Eating much more than before — 40-50 crayfish nightly, plus some worms, frogs, and coddled eggs.
22 - 32	Nov. 15-25. Out daily, usually during daylight hours, feeding very vigorously.	July 30 - Aug. 9. Out nightly, feeding ravenously, much more than usual amount. Not out during day.
33 - 34	Nov. 26 & 27. Out daily, feeding vigorously.	Aug. 10 & 11. Penelope did not come out at all these 2 nights. We do not know why. We opened the 2nd entrance to her clay bank from the wooden sleeping tunnel, and removed her earth plug at the entrance she had been using.
35 - 55	Nov. 28 - Dec. 18. Still eating voraciously. Becoming more nocturnal in feeding activities, coming out at 7:00 or 8:00 P.M. A typical daily meal: 400 worms 338 grubs 38 crayfish Total weight: 1¾ lb. Doing some digging indicative of changes in nesting burrow.	Aug. 12-24. Out nightly, eating heavily. Sample daily meal: 60 crayfish 1½ lb. earthworms 1 frog coddled egg Doing some digging. Freshly dug earth in wooden sleeping tunnels. Now using alternate entrance to clay bank part of the time.
56 - 70	Dec. 19 - Jan. 2, 1944. Noticeable falling off of appetite. Using new entrance to nesting-burrow.	(Nothing exceptional to report up to time of going to press. Penelope eating heavily; no loss of appetite)
71	Jan. 3. Nesting burrow opened. Baby Platypus found, 9" long, eyes closed, entirely helpless. Short, satiny fur. Baby about 8½ weeks old.	
93	Jan. 26. Second inspection of youngster. Eyes newly opened; 11" in length.	
116	Feb. 18. Fourth inspection. Baby now 15 weeks old, measuring 13½" in length.	
124	Feb. 26. Young Platypus left its underground home for first time, for outing in pool. Ate adult food. Weight: 1 lb.	

* For purposes of comparison, I have arbitrarily counted the day of retirement as the *first* day. Thus:
Oct. 25 for Jill — she was last seen at 7:00 P.M. that day.
July 9 for Penelope — she was busy building a nest during the night of July 8, and presumably retired in the early morning of July 9.



If Penelope were as tame as Mr. Fleay's Jill — shown here nuzzling grubs from his hand — we might take the chance of opening her nest.

The actions of the two animals parallel quite closely except for a few details. Jill was markedly more diurnal in her activities than Penelope has been. This could be explained by the difference in temperament of the animals, Jill evidently being calmer and less nervous than Penelope ever was. Jill was accustomed to daylight activity, while Penelope has been largely nocturnal except when brought out during the day for exhibition purposes. We still ask ourselves — why did Penelope not come into her pool or feed on the nights of August 10 and 11? We have no sure answer for that question. It is possible, but not likely, that because of a temporary cave-in of part of her burrow, or the lodging of some obstacle in the en-

trance, she might not have been able to come out for two nights. Another possibility is that she had been rearranging her underground tunnels, and wanted a new entrance to the clay bank. We do know that as soon as we removed her clay plug at the old entrance, and made an alternate entrance available to her, she came out.

The sum of Penelope's actions leads us to the conclusion that she probably has a baby or babies in her underground nest, and we believe that it or they hatched about July 16, the last day of the important week during which Penelope remained underground and did not come out at all.

Mr. Fleay's baby Platypus, "Corry," did not come out of the nest voluntarily until she was four months old. Fleay, however, notes that he has found wandering young Platypuses in the wild which were obviously younger than four months. Ours, then, might be expected to emerge any time from late October to mid-November.

When the weather turns too cold to keep the Platypuses outdoors, we move them to winter quarters in the cellar of the Bird House. During the past six years we have brought them in as early as October 9 and as late as November 1, depending on the weather. If no baby Platypuses have appeared by cold weather time this fall, we will dig into the clay bank carefully until we find the nest. If there are young Platypuses, they should be old enough by that time to stand the shift to winter quarters and eat the same food that the adult Platypuses eat.

Early in November our supposed baby will be 15 weeks old and it should look like this picture of Corry just before she came out.



NEW FACES IN THE ZOO



Photographs by SAM DUNTON

***Many Zebras—but only two of the Grevy species—have
been born in the Zoo. This one arrived on August 15.***





Two females of the Spotted Cuscus were brought to us from New Guinea by George Scott when he returned with Birds of Paradise. Females are grizzled; only males are spotted.



This is "Ugly," a Mantled Howler Monkey brought to us from Ecuador in 1950 as a baby and only now placed on exhibition in the Small Mammal House. It is a magnificent specimen.

Born by Caesarian section early in June, a young Sika Deer fawn was hand-reared by Mrs. Helen Martini in our Animal Nursery, where it developed a great liking for people. Now it has taken up residence in the Children's Zoo and, under the name of "Faline," is a general favorite.





On August 17 we received a pair of Fennecs, delicate and long-eared little foxes of the North African desert country. Trusting yet shy, they will come forward quietly to sniff a visitor's finger, but any sudden motion or alarming sound will send them away in a flurry of alarm.

Like all the Saki Monkeys, the White-headed is rare in zoological collections. This one came to us from Dutch Guiana in July, having been hand-reared in the bush by Mrs. Emy Cordier.

Another rare Saki Monkey is the Red-backed of the American tropics. The Sakis seem to be uncommon even in the wild, and are delicate in captivity. They feed on insects and fruits.





Billy Johnson, an enthusiastic young naturalist, points to the exact spot among the blueberries where he picked up the ancient Box Turtle.

Photo by Ira Rosenberg, New York Herald Tribune

A LETTER received last June from Mr. William R. Johnson of West Kingston, Rhode Island, was part of the routine general correspondence that regularly pours into the Zoo. Mr. Johnson's son, Billy, had found a Box Turtle on his grandfather's farm near Hope Valley, Rhode Island, and he wanted to know if we would like to have it for the Zoo's collection. Actually we need Box Turtles about as badly as we need young Robins to rear. But *this* was no ordinary Box Turtle and we said that we would like to see it.

Billy's Box Turtle differed from the usual run of these turtles in having two sets of initials and dates, EBK 1844 and GVB July 22, 1860, carved on its shell. While forgeries of this sort are too frequent to excite herpetologists interested in the ages of turtles, there are some apparently authentic cases of old dates marked on turtles. Thus all possibilities must be investigated and we wanted to see this one so that we could, if necessary, re-

Young Billy Johnson's Old Box Turtle

By JAMES A. OLIVER

cord it as another fraud — the work of some joker.

When the turtle arrived and I removed it from its neat, newly made, wooden shipping box, I began to lose some of my skepticism. The turtle was an unusually large male Common Box Turtle, *Terrapene carolina carolina* (Linnaeus) and he was definitely an old turtle — the oldest I had ever seen. The upper shell was considerably worn, so much so that the horny layer of shell over the underlying bony structure had been almost eroded away in many spots, revealing the pitted gray bone beneath. The turtle's body had outgrown the shell, making it impossible for him to completely close up the "box."

The style of the initials and dates was suggestive of antiquity, particularly the 4s in 1844. These figures had unusually long ascending and descending strokes with the upper ends on noticeably different levels — distinctly different from the way we make 4s today. In addition, the J in July was peculiarly slanted, a kind of script J that suggested another era. All of these details suggested that *this* turtle might be authentic. Certainly it warranted further investigation!

In our efforts to verify the age of this turtle we took it to the American Museum of Natural History to be studied by John T. Nichols, Curator

And this is the plastron, worn smooth but with the carving still quite legible, of the old turtle. It looks as old as it is seemingly proved to be.

Emeritus of Fishes but an outstanding authority on Box Turtles, and sent the turtle to the University of Florida to be examined by Dr. Archie F. Carr, one of the foremost turtle experts. Both Mr. Nichols and Dr. Carr agreed that the turtle had a high probability of being as old as the earlier date might indicate. Dr. Carr summarized his opinion by stating, "All in all I think this comes as close to being a good hundred-year old Box Turtle as any of us will ever see."

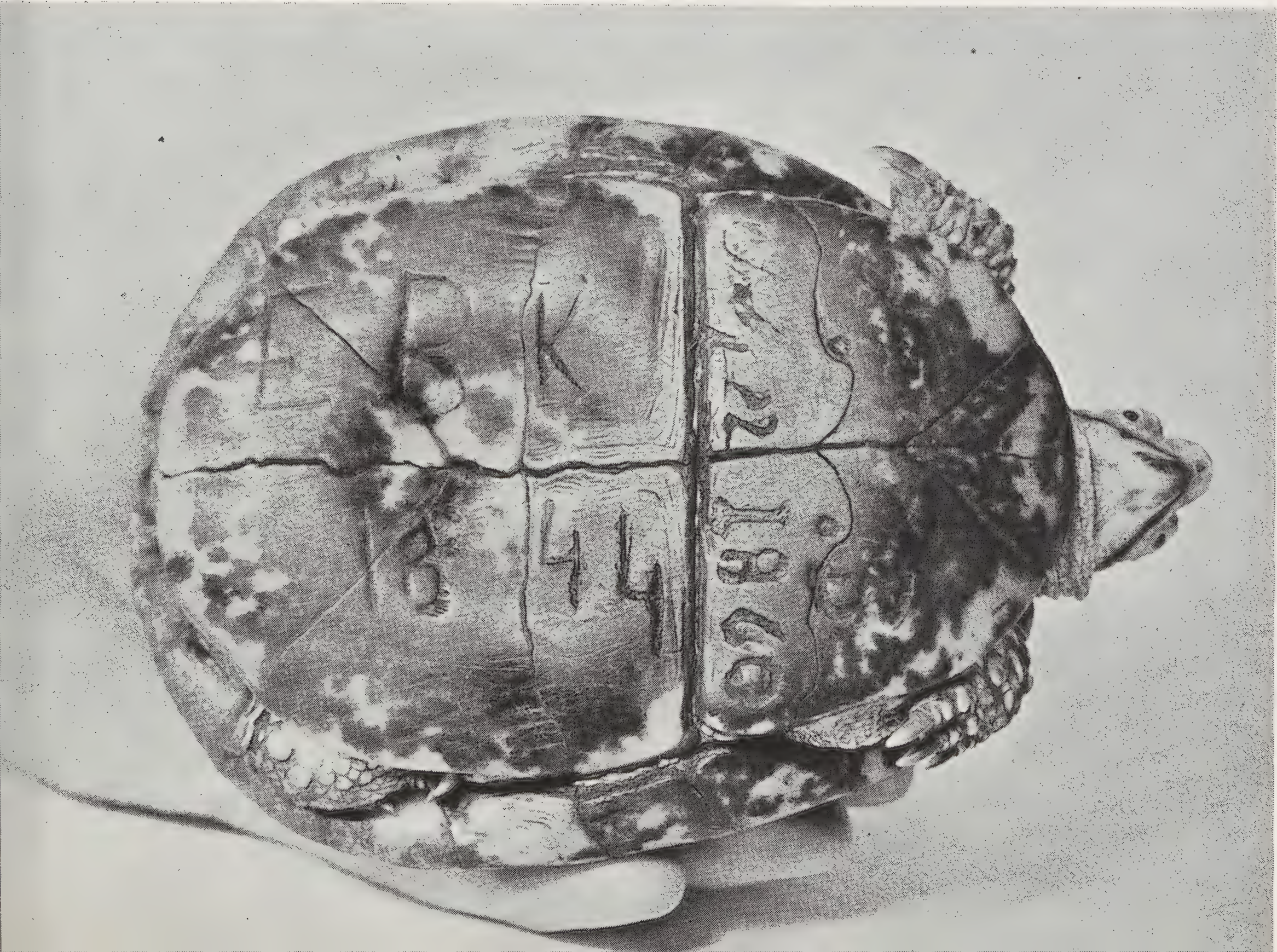
So much for the evidence from the turtle itself. Next we tried to get some information relating to the identity of the initials on the turtle's shell. Staff Photographer Dunton had taken some excellent photographs of the turtle and our Curator of Publications sent out stories and photographs to the New York and Rhode Island newspapers, asking for help from anyone who might know of E B K and G V B in Rhode Island a hundred or more years ago. I wrote to Mr. Laurence Kenyon, town clerk of Hopkinton, Rhode Island, where the records for Hope Valley were kept, hoping that his tax rolls or land records would yield helpful information.

Mr. John Rogers, a reporter for the New York Herald Tribune, received our press release and found the story an interesting one to run down. He proposed that we go up to Rhode Island and



Samuel Reynolds, 85 years old, was encountered by chance in the cemetery at Wyoming, R. I. He knew the grave of Edward B. Kenyon.

Photo by Ira Rosenberg, New York Herald Tribune





get whatever information we could. This we did, stopping first in Hopkinton to interview Mr. Kenyon and see what his records would reveal, thence to the spot where Billy Johnson found the turtle, and finally to the Woodriver Cemetery on Nooseneck Road in Wyoming, Rhode Island, where we finally stopped in late afternoon beside a simple headstone marked E B K. Many people interrupted their regular activities to help us search for the information that would make our turtle an authentic centenarian. They ranged from a boy of five to an old man of 85. It was the aged Samuel Reynolds who led us to the key clue — the grave of Edward Barber Kenyon, 1825-1900, who lived but half a mile from where the turtle was found and whose uncle owned the farm where it was found. Thus Billy Johnson's turtle seems authentically old beyond any reasonable doubt.

The date of 1844 would make the turtle 109 years old in 1953. However, the position of the initials and dates indicates that they were not carved on the turtle until it had attained full shell growth. On the basis of studies made on wild Box Turtles, a period of approximately twenty years is required to reach full shell size. Therefore this turtle must have a minimum age of 129 years and, insofar as we have any records, it is the oldest animal of any kind now alive in the United States.

The span of years based on the date 1844 alone

E.B.K.—the same initials on a simple headstone and on the plastron of the old turtle. E.B.K. would have been 19 when he carved the date.

Photo by Ira Rosenberg, New York Herald Tribune

places this turtle among the oldest Box Turtles recorded. During the twenties and thirties three of these turtles were found in Connecticut with dates that would give them a known span of 110, 111 and 118 years respectively — if the dates were authentic. Only the dates were found on the shells and no effort to verify their authenticity is reported; probably it was not possible to obtain any additional information. These life spans are known to be exceeded only by the large land tortoises of the genus *Testudo*. In *ANIMAL KINGDOM* for May-June, 1953, it was noted that ages of 152 and 177 years have been accredited for two of these giant turtles — the greatest longevity known for any vertebrate animal.

Billy Johnson's Hope Valley turtle, having travelled from the blueberry fields of Rhode Island to metropolitan New York, to Florida and thence back to New York by plane, can settle down again to the leisurely life. He will be comfortably housed in the newly remodeled Reptile House, where he will receive watchful care and attention to his daily needs. Removed from the dangers that all-too-frequently cut short the lives of wild creatures he can grow to a ripe old age of ? years.

News from the Conservation Foundation

Windsor Meeting

At the international gathering at Windsor, England, this summer, addressed by President Fairfield Osborn on population growth and the future of resources, it was the consensus of those in attendance that the conservation of resources by mounting populations in the present century constitutes the most significant problem in the world today. Among those attending the conference were Professor A. V. Hill (President, British Association for the Advancement of Science), Sir Harold Hartley (President of the World Power Conference), Sir Walter Moberly (Principal of St. Catherine's), Sir Charles Darwin and Sir Bernard Keen (Director, East African Agriculture and Forestry Research Organization).

The Limits of the Earth

Little, Brown & Co. is publishing Fairfield Osborn's new book "The Limits of the Earth," on October 9. This book explores further and presents new light on the "eternal equation": the pressure of expanding populations on natural resources and human welfare throughout the planet.

Publication of Research Data

The first three books containing the results of recently completed Foundation research programs will be published this fall by Ronald Press, as follows:

OCTOBER — *Conservation Law and Administration: A case study of law and resource use in Pennsylvania.*

By William F. Schulz, Jr., Pittsburgh School of Law.

NOVEMBER 15 — *Wildlife in Alaska: An Ecological Reconnaissance.*

By Starker Leopold and Frank F. Darling.

NOVEMBER 15 — *Vegetation and Watershed Management: An Appraisal of Vegetation Management in relation to Water Supply, Flood Control and Soil Erosion.*

By E. A. Colman.

Two further publications of Foundation research results will appear in January and May of 1954.

Mid-Century Resources Conference

Lewis Douglas, our former Ambassador to Great Britain, has accepted the chairmanship of the forthcoming Mid-Century Conference on Resources for the Future to be held in Washington, D. C., under sponsorship of the Ford Foundation, December 2 and 3. Officers of the Conservation Foundation have participated in preliminary planning and preparation of panel papers. Samuel H. Ordway, Jr., is Counsel to the Conference. President Eisenhower has assured his Administration's support of the Conference by instructing Federal Departments and Agencies to assist in the preparatory work.

Controversial Item

Samuel H. Ordway, Jr., Vice-president of the Foundation, is publishing in November a short essay entitled "Resources and the American Dream — Including a Theory of the Limit of Growth." This essay contends that economic and industrial expansion places more serious pressure on natural resources than population growth, and that continuing consumption of raw materials in excess of reproduction can destroy the American dream of ever higher levels of living. Since the theme of this essay is based upon an individual opinion, not generally shared by the staff of the Foundation, the book will not be a Foundation publication.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Another Mountain Tapir Comes from Colombia

When our first Mountain, or Woolly, Tapir arrived from the Ecuadorian Andes on November 26, 1950, its arrival was extremely exciting zoological news, for no Mountain Tapir (*Tapirus roulini*) had ever before been exhibited alive — and, indeed, for a long time zoologists had not been sure that it existed.

On June 19, 1952, we received another specimen, this time a young male. The first one subsequently died of tuberculosis, on December 8, 1952, and the young male, which never showed a liking for any of the many foods that had been accepted readily by the female, died on November 2, 1952.

Now we are trying again with some strong hope of being able to keep and exhibit this rarest of all the tapirs. A young female, probably about six months old because it still shows traces of its baby stripes, came from the village of Popayan in Colombia on September 4. It is on exhibition in the Antelope House.

Staff Members at Conferences Here and Abroad

Their special professional interests have taken several staff members across the United States and into Europe this summer. Director John Tee-Van returned at the end of September after six weeks visiting European Zoos and exchanging ideas with Zoo directors abroad.

Curator-Aquarist Christopher W. Coates of the Aquarium and General Curator Emeritus Lee S. Crandall attended the meeting of the American Association of Zoological Parks and Aquariums in Denver in September, and afterward Mr. Coates joined in the meeting of the eastern section of the American Fisheries Asso-

ciation at Breton Woods, N. H.

Dr. Ross F. Nigrelli, the Aquarium Pathologist, took part in an important symposium on diseases of North American fish at Milwaukee and, with Dr. James Westman, presented a paper at the Breton Woods conference.

Dr. Myron Gordon, the Aquarium's Geneticist, attended the International Congress of Zoologists at Copenhagen in August, presenting a paper on the inheritance of cancer in fishes. Later he was chairman of the section on sex determination at the Ninth International Congress on Genetics at Bellagio, Italy.

Staff Photographer Sam Dunton showed two of the Society's motion pictures and gave a paper on Cinematography of Fishes and Reptiles at the meeting of the Biological Photographic Association in Los Angeles. One of his pictures, of a Tiger Swallowtail caterpillar, won first prize in a photographic contest among members of the group, and another, of a Parasol Ant, received honorable mention.

New Casting Pool Is Open to Fishermen and Casters

The new casting pool near the Bronxdale Gate of the Zoo was opened for actual fishing on September 12, having been stocked with 5,000 sunfish and about 40 catfish and carp from ponds in the Park.

Only anglers under the age of 16 are allowed to catch fish, and they must use barbless hooks. Older persons may use the 90 x 190-foot pool for precision casting practice with hookless plugs or flies. Fishing by youngsters is free, but practice casting will be charged for at the rate of 25 cents a half hour.

The pool will be open every day except Thursday during normal Zoo hours, until cold weather. Designed by the New York City Department of

Parks, built by the State Conservation Department and operated by the Zoological Society, it will be under the charge of Curator-Aquarist Coates.

ZOOLOGICAL PARK MISCELLANY

The prolonged heat wave in late August and early September had surprisingly few ill effects on the animal collection, although Park trees, grass and shrubs suffered severely. The most notable effect of the high heat was the increased appetite of the crocodilians in temporary quarters in the Aquatic Bird House annex. This structure is glass-roofed and the heat was intense, but the Alligators, Crocodiles and Caimans luxuriated in it. They ate fully 25 per cent. more than their normal rations during the hot spell and at times were a menace to their keeper, for in their eagerness for food they rushed forward and snapped at his feet whenever he appeared. . . . Incorporating a section of lead pipe dug up at Pompeii and brought back by a soldier, a new drinking fountain was installed on the west side of the Fountain Circle on September 24. . . . Several of the newly-arrived Birds of Paradise have already begun courtship displays. They are most likely to display on dull, cloudy days. . . . A White-handed Gibbon was born to the pair in the Great Apes House in August and for some

weeks may be seen clinging to its mother. . . . Some months ago we placed an order for a young female Hippopotamus as a companion for our Little Pete. She arrived on approval on September 9, but turned out to be several times larger than Peter the Second. Consequently she was returned to the importer, who is currently looking for a real baby Hippo of about 300 pounds' weight. . . . Four South American Poison Frogs, *Dendrobates auratus*, have been received from — of all places — Hawaii. Native to lower Central America and extreme northwestern South America, they were introduced in Hawaii some years ago to prey on insect pests. Now they are well established and are reproducing in Oahu. Since Hawaii is an American Territory, it is easier and quicker to obtain them from Hawaii than from Central America. Our four specimens were sent to the Reptile Department by Paul Breese, Director of the Honolulu Zoo. . . . Fall opening of the Reptile House, closed during the summer because of complete remodelling of the interior, has been delayed by prolonged strikes of concrete truckmen during the summer. . . . Early in September Dr. John V. Quaranta, our Research Associate in Animal Behavior, and Julian Melhado of Western College brought to a close their summer work on maze learning and the influence of color on the social behavior of ducklings, and the color vision of Garter Snakes and Water



The four Little Women—baby Chimpanzees—have had a lively summer out of doors at the Great Apes House. The metal slide was no fun on hot days, but they found other amusements.

Snakes. Dr. Quaranta will continue the snake project during the winter. . . . On the death of our only Bald Eagle on August 22, it had made our best eagle longevity record. Hatched early in 1930 on Little St. Simon's Island, Ga., and received here on September 2, 1931, it was the subject of Mr. Crandall's paper, "Notes on Plumage Changes in the Bald Eagle," published in *Zoologica* in 1941. Photographs showed complete sets of shed tail feathers of seven consecutive years and established the age at which the species acquires its adult plumage.

PUBLICATIONS OF INTEREST

HOW ANIMALS MOVE. By James Gray. xii + 114 pp., 15 photographic pls. and 52 figs., New York: Cambridge Univ. Press, 1953. \$3.00.

One of the important characteristics of animal life as compared with plants is the ability to move about actively from place to place. This movement is accomplished by different means in different groups of animals and involves many different organs of locomotion. Thus some swim, some walk or run, some crawl or creep, some hop, some glide or fly. What organs enable animals to do these things? Do all those that swim have the same or similar organs? Have different animals developed different methods of swimming? How *do* animals move?

Professor James Gray of Cambridge University has spent a fruitful lifetime finding the answer to these and many other questions on animal locomotion. This attractive little book is the result and gives a clear, concise summary of information on the mechanics of animal movement — and presents this information in easily understood terms. This last point represents a considerable accomplishment in itself because of the complexity of the mechanical problems involved in an analysis of these movements. Professor Gray has attained a large measure of success in presenting a full account of these matters, as well as in stressing the beauty of form and structure which give grace to virtually every type of locomotion. — J. A. Oliver.

THE CARE AND TRAINING OF HOME CAGE BIRDS. By Bernard Poe. Pp. 120, 12 pp. of illustrations and 3 diagrams, in black and white. G. P. Putnam's Sons, New York, 1953. \$2.50.

As stated by the publishers, Bernard Poe is the pseudonym of "a well-known authority on bird lore . . . who is a professor of zoology at an American university." The text bears out the statement well, for on technical points such as the reproductive, digestive, respiratory and circulatory systems of birds, it has been carefully and accurately done. On matters of direct and practical interest to bird keepers, the book is on a distinctly lower level. Either Bernard Poe's sources were not the best or his interpretations were not always well thought out, for the material is so uneven that the book is not completely useful. — L.S.C.

TIGER. The Story of a Swallowtail Butterfly. By Robert M. McClung. 46 pp., many illustrations, half in color. William Morrow & Co., New York, 1953. \$2.00.

There is an impressive number of children's books concerning the life of this or that mammal or bird, few informative and even fewer accurate. For this reason *Tiger, The Story of a Swallowtail Butterfly*, is a very welcome addition to any small child's library, filling an otherwise vacant space both in the library and the child's mind. It is the story of the life of one of our most beautiful and common butterflies, which every child sees but few know, accurately illustrated by the author both in black-and-white and in color.

Adults who must read to the four- or five-year-old child will welcome this book, as they have Mr. McClung's former books, for its attractiveness and well-written style. Older children will enjoy it for the same reasons but also because *Tiger* will reveal a new world to them. — H.F.

ZOO BABIES. By William Bridges. Illus. 56 photographs in black and white, pp. 95. William Morrow & Co., New York, 1953. \$2.50.

The large type in which this attractive little book is printed, as well as the title, indicate a presumed major interest for children. Actually, an optimum age level would be difficult to determine, for while the style is simple, the subject matter will interest anyone with even a glimmer of feeling for animals. The stories are well told, factual accounts of happenings in the New York Zoological Park, usually, although not always, relating to animal "babies." — L.S.C.

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EVERY FALL WE LOSE TRACK of some of our friends because they move — and don't let us know about it. This very copy of ANIMAL KINGDOM may have been toted around for weeks before it reached you. Some numbers of this issue will *never* get to the people for whom they were intended.

Will you please check the address on the envelope in which this magazine came? If it is not correct — if the magazine has had to be forwarded — will you be so good as to give us your proper location? Thank you a lot.

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New York Zoological Society

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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The New Aquarium

WE ARE ON THE WAY — at last! “We” means that good working partnership comprised of the City government and our own institution. This autumn Commissioner Moses recommended to the Board of Estimate of the City that an appropriation of \$537,500 be made in order to meet the construction costs and opening expenses of the first stage of this great new project. In making this recommendation, he stated the satisfactory fact that our Society was prepared to put up a similar amount. Favorable action regarding this appropriation has been taken by the City and consequently we expect that by next Spring “the dirt will fly” and that the building of the initial stage of the New Aquarium, which we have planned for over so long a period, will actually be under way.

It has indeed been a long time to wait, for the old Aquarium at the Battery was closed because of the construction of the Brooklyn Battery Tunnel, way back in 1941. The momentous world events of World War II and the Korean War, with their economic aftermaths, resulting in restrictions on new construction, have been the direct cause of so great a delay. We can only hope that there will be no other similar interruptions and that when this first part of the New Aquarium is constructed we may find the funds and go on to the completion of this superb project. The greatest city in the Western World needs this institution where the life of the inland and ocean waters may be viewed by its citizens, as well as by visitors from far and wide. This objective will be a driving purpose for our Society in the years that lie immediately ahead.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.



"No comment!"

NO BABY PLATYPUSES at the Bronx Zoo this year. That is the story in a nutshell, as practically everyone who reads a newspaper or owns a radio or television set has known since November 5.

As was reported in the September-October issue of *ANIMAL KINGDOM*, we had hoped and expected that Penelope had babies in an underground nest in her clay bank. Her behavior pattern in recent months indicated that she did. Already international celebrities as the only living Platypuses outside of Australia or Tasmania, Penelope and Cecil had again been in the news since July, because their actions suggested probable parenthood. But our Platypuses muffed the big chance for further laurels. When we dug into Penelope's clay bank, we found exactly nothing . . . nothing, that is, except numerous tunnels — and Penelope herself. No nesting chamber. No eucalyptus leaf nest. No young Platypuses.

To get the proper perspective on that bitter moment, it is necessary to think back over the previous four months. Our hopes had first been kindled on June 21, when Cecil and Penelope were observed in courtship. Those first few hopes had grown stronger and stronger as Penel-

ope subsequently carried nesting material into her tunnels, and then remained underground, to the best of our knowledge, for almost a week. We thought she was incubating eggs. When she reappeared, she demonstrated a ravenous appetite, which was another good sign. Throughout August and September and October, Penelope con-

Digging in Penelope's clay bank started at 8:48 A.M. The screen wire was a protection against marauders.



tinued to consume great quantities of crayfish, earthworms and coddled eggs nightly. We were almost certain she must have babies.

We would not know for sure, however, until we opened up the clay bank, which we would have to do with the coming of cold weather. Of course, there was the possibility that any young Platypuses might leave the nest and appear in the swimming tank before we opened the clay bank, but we did not count on that happening.

During October we decided to build a new indoor Platypusary so that Penelope and her offspring could be exhibited during the winter. Plans were drawn up and the new Platypusary was speedily constructed.

By the last week in October, the new Platypus home was almost ready. Tension grew, for it was almost time to dig. We had delayed digging for as long as possible, so that the young could be left undisturbed until they were close to the weaning age. We already had had a wonderful break with the weather, for one warm sunny October day followed another until the end of the month. We could not stretch our luck too far, so it was decided that unless a sudden cold spell forced us to dig earlier, we would open the clay bank on Thursday, November 5. By this time, any young would be almost sixteen weeks old. At that age a young Platypus should be

about thirteen inches long, weigh in the neighborhood of a pound, and be about ready to start foraging for itself.

As subsequent events showed, we were lucky only in the choice of the date for digging. The day was bright and sunny with the temperature in the fifties. Less than twenty-four hours later the thermometer had dropped to below freezing, and a sudden snow storm blanketed the New York area.

Bright and early on the morning of November 5, all was ready for the suspense-laden occasion. Wheelbarrows, shovels, trowels and tarpaulins were ranged at the scene. Scales for weighing the Platypuses were placed near at hand, as were three grass-lined travelling cases to be used for carrying them to their new home. A special platform for the convenience of press photographers had been built over Penelope's pool.

While almost two-score officials, reporters and photographers watched with ill-concealed anticipation, the digging was started in a corner of the clay bank, furthest from the wooden burrows and pool. Everyone settled down to a long watch, for there were over 280 cubic feet of earth in the pit, and the digging had to be done very slowly and carefully. Bit by bit the earth was removed, exposing tunnel after tunnel at various depths. At 10:45, after two hours of digging, only a two-foot-wide strip of earth next

away from the job and the hard-packed earth had a tendency to come away in large chunks.

Every tunnel — and there was a honeycomb of them just below the surface — was carefully investigated.





*Getting close! Only a few cu
feet of earth remained and ea
tunnel might reveal the babi*

*Penelope herself came to light
at 10:45 A.M. when all but the
last two feet of dirt was gone.*



to the wooden burrows remained to be explored.

It was then that a movement was observed in one of the partly exposed tunnels. Then a patch of dark brown fur was seen. Almost simultaneously there was a movement at a hole two feet away. Then a Platypus backed out of a third hole between the other two, and was quickly picked up by Keeper John Blair.

For one triumphant moment, we were almost sure that we had seen two animals, and that this was a young one, almost as big as its mother. But a second look showed us that it was Penelope. Anxiously, we explored the few remaining tunnels. There was nothing more.

With the faint hope that we might somehow have overlooked a deeper tunnel or nest, every bit of earth was then removed from the clay bank. Finally, the wire bottom was exposed, but

nothing further was found. None of Penelope's tunnels had been any deeper than two-and-a-half feet below the surface. Several small chambers or blind pockets were exposed, but no room considered to be large enough for a nesting chamber was found. No nest or eucalyptus leaves were found, either.

After being photographed and weighed, Penelope, in a highly nervous state, was placed in her new quarters in the Heads and Horns Museum. In spite of her enormous intake of food all summer, she weighed only 1.56 pounds, as compared with 1.73 when she was placed in the outdoor Platypusary last spring. Her fur was in fine condition, her tail showing none of the patches worn bare by "pugging," which nursing female Platypuses sometimes show.

The male Platypus, Cecil, was then weighed

and he was transported to the new Platypusary, too. He weighed in at 3.14 pounds, as compared to 3.65 in the spring. It is planned to exhibit the animals alternately this winter, when they have settled in their strange new quarters.

So it is that our 1953 Platypus breeding attempt ended in failure and disappointment. Though the outcome is now finally known, part of the uncertainty and puzzlement we had felt all summer still remains. We still don't know what happened to the nesting material which Penelope took into her clay bank. And we don't know what induced Penelope to go through all the motions, with no results.

What happened to the eucalyptus leaves? All the evidence shows that Penelope took leaves into her clay bank — we do not know just how many, but a considerable quantity. Some trace of them should remain, for they should not entirely decompose in four months underground,

It was moving day for Cecil, as well as Penelope. Keeper Blair took him from his wooden tunnel.

And this is Penelope after it was all over — excited and moving fast, not at all penitent.



especially if all were put in one place. It is possible that Penelope never built a proper nest. She may merely have taken leaves into her burrows and dropped them at various places in her tunnels. There they might disintegrate individually, from the dampness and from the wear and tear of Penelope's daily comings and goings.

Lastly — why, oh why, did Penelope act out Platypus breeding behavior so closely, all to no avail? Several theories might account for it. Penelope may actually have laid eggs and even hatched baby Platypuses. Something perhaps happened to destroy the eggs or tiny babies at an early stage. Again, it is possible that Penelope was ready for mating in June, but that the moment when mating and fertilization of her

ova should have occurred had already passed when she and Cecil were given the opportunity for mating. Her aroused maternal instinct might still function and cause her to go through all the phases of maternal behavior without actually laying eggs.

All the above, of course, is mere conjecture, for we will never know all the details of what actually happened. In spite of our disappointment, we still have hopes for the future. There's always next year.

In this attractive new Platypusary in the Heads & Horns Museum, Penelope and Cecil are to be on exhibition this winter.





The Elusive Massena Trogon

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

A very rare picture of an adult Massena Trogon (at left, and below). It is carrying insects to the young in its nest nearby.

Photos by Alfred O. Gross

ON MY FIRST LONG VISIT to Central America, I saw just enough of the trogons to give them a unique place in my esteem. A family of birds so lovely, so retiring, with habits so shrouded in mystery, became for me the type and symbol of the marvelous bird-life of tropical America, far richer and more brilliant than that of any northern land. The males are clad in glittering, iridescent colors: green, golden-green, metallic violet or blue on the upper plumage, with bright red, orange or yellow on the under parts. The duller females are brown, gray or slate, with the yellow or red of the abdomen often less extensive and brilliant than on the males. Trogons are about as big as pigeons and doves but have a distinctive manner of perching, holding themselves upright with their tails pointing almost straight downward. Their bills are short and stout. Their flight is strongly undulant, like that of many woodpeckers. The calls of trogons are full and mellow, or more rarely loud and raucous, too simple in form to be called songs except in a technical sense. With that dignified, upright carriage, elegant attire, gentle ways and usually restrained voices, the trogons are the perfect gentlemen of the tropical American bird-world, as the toucans are its buffoons and the woodpeckers its industrious artisans.

My first half-year in Central America was passed amid the banana plantations and winding lagoons of the Almirante Bay region of Panamá, where I dwelt too far from the forest to meet many trogons. But the following year I lived in the Lancetilla Valley of northern Honduras.





Within an easy walk of my lodging began the magnificent rain-forest that spread with scarcely a break over the steep slopes of the coastal mountains. The tall, slender, crowded trees rose to heights of well over a hundred feet, and beneath their lofty canopy the light was dim and subdued even at mid-day. The undergrowth, rich in small palms, was rarely so dense that it seriously retarded a man's advance as in the neighboring second-growth thickets, where every forward step was won at the cost of vigorous swinging of a sharp machete. In this stately forest I began to learn the ways of the distinctly woodland birds.

As in all localities where a man dwells for a while, I soon discovered favorite spots amid the surrounding wilderness, too vast ever to be thoroughly explored in the detailed, time-consuming manner of a naturalist. One of these was a narrow dell, not far within the edge of the forest, through which a stream of clear mountain water leapt and tumbled down a boulder-strewn bed, pausing here and there in a fern-rimmed pool where hummingbirds dipped for their baths. In this enchanting spot I found my first baffling nest of the Royal Flycatcher, a yard-long mass of tangled vegetable fibers that one never would have taken for a bird's nest. This first exciting discovery called for repeated visits, which in turn, as so often happens, led to other momentous disclosures. One morning, when I went to visit the flycatcher's nest hanging above the mountain torrent, a male Massena Trogon, resting quietly on a bough above the stream, calmly viewed me and my companion as we clambered laboriously over the slippery rocks. One of the bigger trogons, he was a stocky bird clad mostly in glittering green, except his bright red breast and belly and his wing coverts minutely pencilled with black and white. His short, thick bill was red. I thought that he needed only a crest of upstanding feathers and a long, curving train to rival in splendor his relative the Quetzal, perhaps the most gorgeous bird of the Western Hemisphere. But at that time I knew the Quetzal, a species confined to

The author's first Trogon nest was discovered by accident in a termitary attached to the trunk of a forest tree. There were three large eggs, in tints of palest blue, in the cavity.

Photo by Alexander F. Skutch

the highlands, only from pictures and stuffed specimens, which never give an adequate conception of this superb creature in all its vital glory.

The following day I noticed a hole in the trunk of a small tree growing beside the stream, close by the point where I saw the trogon. Picking up a stone, I tapped against the trunk. My pulse leapt up when the brilliant bird flew out, not from the hole on which I had my eye, but from a big, black termites' nest attached to the other side of the trunk. It was my first trogon's nest, in an unexpected situation.

The thick, slippery trunk, encumbered with vines and air-plants, repulsed my effort to scale it and see what the nest contained. In the afternoon I returned with a helper, bringing a machete and some cord. We cut two long poles which we notched, then tied short lengths of branches between them, and soon had a ladder that would reach the nest, fifteen feet up. The trogon had flown out as we worked. Eagerly I climbed up and stuck my hand into the blackness of the hole that opened in the side of the termitary, for even with an electric torch it was impossible to see the bottom of the nest cavity. A short tunnel led obliquely upward into the top

of a roomy chamber. On the bottom of this, reposing merely on some hard, black chips of the material of which the termitary was made, my fingers encountered three large eggs. Carefully I lifted them out, one by one, and found them of the palest tint of blue, verging on whiteness. They were soiled with a gummy substance to which many minute particles of the birds' feathers stuck closely, giving them a mottled aspect. A few soft-bodied, white soldier and worker termites crawled over my hand, evidence that the thick-billed birds had carved their nest chamber into the heart of an occupied termitary, almost as hard as wood, and defended by a legion of soldiers ejecting a white, viscous substance from their syringe-shaped heads. However effective this gum may be in embarrassing the movements of ants and other insect enemies, it had proved to be an inadequate defense against the birds.

With affectionate care I replaced the eggs, elated by the prospect of following, day by day, the development of the nestlings that I hoped

Beside this stream in the rain forest of Honduras the Massena Trogon made its home. Here hummingbirds came to bathe in the little pools.

Photo by Alexander F. Skutch



would hatch from them, until they grew feathers and flew off into the forest. Each time that I visited the dell, I tapped the trunk to make the incubating bird fly out of the termitary, and thereby learned something of the division of labor between the two mates. Between eight to half-past eight in the morning and four to half-past four in the afternoon, it was invariably the green male who emerged. Earlier or later in the day it was his slate-gray, red-bellied mate, who apparently spent the night on the eggs. Usually the bird that I had disturbed perched quietly on a bough not far off, slowly raising and depressing its tail and uttering not a sound; for the trogon, despite the dash of its upward swoop to pluck a berry from a twig while it poises momentarily on beating wings, is one of the most phlegmatic of birds. One noon, however, the male flew to a branch above the torrent and called repeatedly, *wuk wuk wuk wuk wuk*, the notes following each other rapidly with a slight increase in pitch. This call was in no sense melodious. I thought it rather subdued, in keeping with the dignified, retiring conduct of its author; but as I toiled up the mountainside between the thorny palm trees I discovered that it had great carrying power.

After I had learned the hour when I might expect it to occur, I waited to witness one member of the pair relieve the other of the duty of incubation. Late one afternoon I concealed myself behind a rocky ledge, above which I had piled some leafy boughs through which I could peer. I had not long to wait, for at very nearly the expected hour the female trogon dropped down from the high trees and came to rest on a bough above the stream. Then she flew to a perch directly in front of the doorway of the nest. The male stuck forth his head, and a few moments later flew quietly out and away. A minute later his mate entered. The whole exchange of duty was effected without the utterance of a note audible to me, or any sign of greeting between the two partners.

Early the following morning I retired behind my ledge of rock beside the rushing current, where, tormented by a swarm of merciless mosquitoes, I waited quietly for the male trogon to come and relieve his mate of her long night's brooding. The sweet, pure notes of a Gray's

Thrush, sounding even more ethereal in the dim recesses of the forest than in the cleared lands where this songster is more frequently heard, mingled with the murmur of falling waters and the wild piping of the Royal Flycatchers foraging across the stream. An hour dragged by and still no trogon appeared, although it was past the time when I had learned to expect him. Weary at last of feeding insatiable blood-suckers while I fruitlessly watched, I was just slipping forth from my retreat, when he appeared as though from nowhere and took his usual perch above the stream. I quietly slid back to my place of concealment, apparently unnoticed by the bird, who remained sitting very upright, slowly raising and lowering his tail. He flew to a second twig, then to a perch directly in front of the entrance. When his mate failed to show her head, he called in his lowest voice. Although his notes were inaudible to me above the laughter of the stream, I clearly saw the vibrations of his throat. Still no response! Flying now to the doorway, he poised on wing before it for a moment, then perched and called again. At last he entered. Seven minutes later a bird emerged from the termitary and flew swiftly away through the forest beyond the stream. In the deep shade its plumage looked so dull that I felt sure it was the female. Could two birds find room in the chamber, and was this the mate who was so reluctant to come forth? Advancing now to the tree, I tapped the trunk with a stone — but no trogon obeyed my request to come out.

I climbed the ladder to learn the meaning of this puzzling behavior. On its topmost round lay some downy gray feathers, tipped with red. There were more of these on the broad surface of a heart-shaped aroid leaf close below it. I sensed tragedy. Had I not just seen the trogon fly out, I should not at once have stuck my hand into the dark cavity; for I had encountered snakes and wasps and fiercely stinging ants in the interior of abandoned birds' nests often enough to make me cautious. I well understood the male trogon's hesitancy in entering; for the snake or sharp-toothed rodent, or whatever else had raided the nest during the night, might still be lurking within.

On the bottom of the deserted chamber my fingers encountered only a few fragments of egg-shell and some seeds regurgitated by the incubat-



se fruits, with bright
shells and white and
py interior, are favor-
of the Massena Trogon.

Photo by Alfred O. Gross

**Massena Trogons four days
old. They were hatched in
a termitary on Barro Col-
orado, in the Canal Zone.**

Photo by Alfred O. Gross



found of some special use to the bird. But to the famous English bird artist the trogons were merely glittering skins; he knew little about their habits, and not a great deal had been discovered since he wrote. The excavation of the nest chamber in a hard termitary is the use which Gould conjectured long ago.

I made my last visit to the mountain torrent early in November, just after the rainy season had reached its climax with a tremendous downpour of twenty-two inches in two days. The current tumbled down its rocky bed with a thunderous roar, but the turbidity that marked the crest of the flood had gone and its forest-filtered water

ing birds, mixed with the debris of the termitary that covered the floor. It was beyond doubt the male whom I had seen steal away so quietly through the woodland. Some mishap had befallen his mate and her eggs during the long night shift, and an empty nest remained to greet him on his return in the morning. As I walked sadly back to the plantation, I should have given much for some intimation of his feelings as he flew off alone into the forest.

For weeks afterward, as I wandered through the mountain forest, I tapped the trunk of every tree which bore a termites' nest; but never from another did a bird dart forth. More than fifty years earlier, in his magnificently illustrated "Monograph of the Trogons," John Gould had expressed the conjecture that the remarkably heavy bill of Prince Massena's Trogon would be

was again crystal clear. The aspect of the dark surrounding forest had altered little since June, when I found the trogons' nest; there were still scarcely any bright flowers to relieve the greens of the multiform foliage. On the side of the termitary where the entrance to the nest had been, a circular patch of dark brown contrasted with the dull black of the rest of the surface. I sought the ladder that I might climb up and examine the changes that had occurred, but the dampness had long since rotted the cords that bound it together and the pieces had been carried away by the flood. With the midrib cut from a huge palm leaf, I prodded that black mass until a swarm of white termites poured out, proving that their nest was well populated. They had regained full possession of their citadel and repaired the damages that the trogons had wrought.

The tragedy of the trogons was but an episode in the life of the termitary.

AS I LOOK BACK after the lapse of many years, it is easy to see the mistakes which as a novice in the study of tropical birds I made at my first trogon's nest. I should have watched it throughout the day from a carefully-sewn blind of substantial cloth rather than at selected intervals from behind leafage that only partially concealed me. But since these trogons were less suspicious of man than many other birds, this was not a serious mistake. A graver blunder was leaving the heavy ladder against the nest tree between visits, instead of carrying it a good way off after each inspection of the nest. In tropical rain-forest, the predation upon birds' nests is far heavier than is usual in northern fields and woodlands, so that in even the most cunningly concealed of these tropical nests the probability of disaster is greater than that of success. Moreover, it has sometimes seemed to me that any interference by man, even a light touch which might leave a telltale human scent, decreases the nest's chances of escaping predatory creatures. But this must always remain a mere conjecture, for it is obviously impossible to compare the success of the nests that we find and examine with those which remain undiscovered.

In later years, I found in various parts of Central America the nests of eight other kinds of trogons, including the glorious Quetzal. Some were in decaying trunks; some, like that of the Massena Trogon, in hard black termitaries; and some in big wasps' nests made of silver-gray carton. In form the cavities made by the trogons are of several types. Those made in decaying wood by Mexican, Collared and Black-throated Trogons are open niches, which leave much of the incubating bird visible from the front. Those carved into wood by White-tailed Trogons are well-enclosed chambers with an upwardly directed entrance-tube, like that of the Massena Trogon. The Quetzal's hole is a deep, roughly cylindrical cavity with a round doorway at the top, like a big woodpecker's nest. The well-enclosed chambers of the Gartered Trogon are made in hives still occupied by the wasps when the birds claim them, but most of the winged defenders are caught in the air before the birds begin to carve out their nest chamber. Doubtless

they feast upon the tender larvae and pupae of the wasps while engaged in this task. With Gartered, White-tailed and Citreoline Trogons I have watched male and female take turns at the work of carving, and doubtless this is the rule in the family. Likewise the two partners share the work of incubating the two or three eggs, even the resplendent male Quetzal sitting in the nest for long periods every day. By night, the female of all the species studied takes charge of the eggs and nestlings. Both parents feed the young, but with some families I have known the male to take sole charge of them during their last days in the nursery.

Even where trogons seem to be abundant, their population is sparse as compared to that of many kinds of birds, and their nests are not easily found. On the Costa Rican farm where I have dwelt for a dozen years, Massena Trogons are not uncommon in the woodland, yet I have seen only one completed nest. This, my second nest of the species, contrasted strongly with that beside the mountain torrent in Honduras. Instead of in a termitary, it was eight feet up in a massive, charred, decaying stump; instead of in the dim woodland, it was in the shady pasture behind my house, but only twenty yards from the forest's edge. But its form was the same as that of my first nest in the termitary, a chamber carved deep in the soft wood, contrasting sharply with the open niches of the Black-throated Trogon that I sometimes found in the neighboring forest. The nests of a single species of trogon seem to be more constant in the shape of the cavity than in the material in which they are carved. There were three eggs, as in the memorable first nest, and they fared no better than that earlier set. Before they hatched, some hungry animal tore away the wood to enlarge the entrance to the chamber and carried them off. After nearly a quarter of a century, I have still to see nestlings of the Massena Trogon.

SCIENTIFIC NAMES OF SPECIES MENTIONED,

IN THE ORDER OF THEIR OCCURRENCE

Royal Flycatcher — *Onychorhynchus mexicanus*

Massena Trogon — *Trogon massena*

Quetzal — *Pharomachrus mocinno*

Mexican Trogon — *Trogon mexicanus*

Collared Trogon — *Trogon collaris*

Black-throated Trogon — *Trogon rufus*

White-tailed Trogon — *Trogon strigilatus*

Gartered Trogon — *Trogon violaceus*

Citreoline Trogon — *Trogon citreolus*



Huasteca Canyon is as wild today as it was a hundred years ago when Lieut. Couch was collecting platyfish in the area.

Photos by the Author

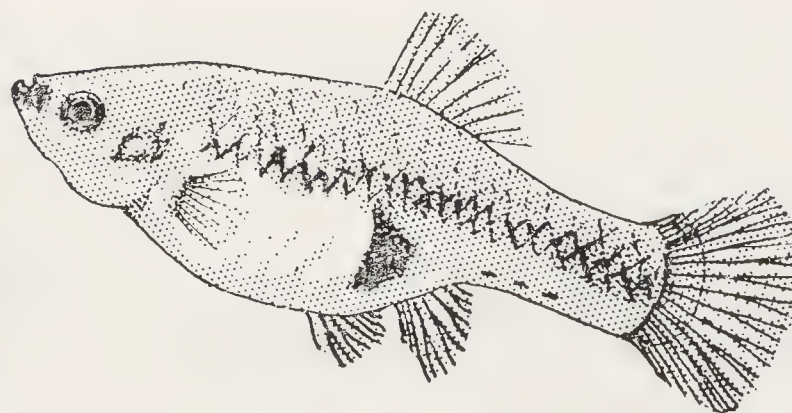
IN 1853, just a hundred years ago, the Mexican War had been over only a few years and Lieut. D. J. Couch obtained an appointment that took him back, in peaceful pursuits, to the country where he had distinguished himself by bravery in battle. The beauty and strangeness of northern Mexico had fascinated him, and after getting a leave of absence from the Army he induced the new Smithsonian Institution in Washington to send him back as a collector of zoological specimens. Lieut. Couch was not the first nor the last man to talk some institution into paying him for doing what he ardently wanted to do anyway.

It happened that he had won his military distinction in a skirmish at Buenavista, a village not



In the Footsteps of Lieutenant Couch

By MYRON GORDON



far from Monterrey, and it was perhaps natural that he should collect intensively in that area which he knew intimately. In any event, there he came upon a small, nondescript fish that, except for him, might well have gone unnoticed for many more years, since it appears (now, at least) to be restricted to a geographically minute range in the river that flows from the Huasteca Canyon at Santa Catarina to Monterrey, a distance of only ten miles.

Lieut. Couch pickled a number of these unprepossessing fish and they, among many others, were duly forwarded to the Smithsonian, where the great Charles Girard just as routinely studied them. Girard was the ichthyologist directed by the Government to describe the fishes along the new international boundary between the United States and Mexico, a labor that resulted in the first authoritative ichthyological treatise on the region. The fish from Monterrey turned out to be previously undescribed, so Girard — as is fre-

quently done — named it after the man who sent it to him. Thus today it is known as *Xiphophorus couchianus* (Girard), the most northern and least known of the platyfish and — most importantly to us — a most valuable tool in the Aquarium Genetics Laboratory's study of melanomas, or black cancers.

Forty-nine years passed before any more specimens followed Lieut. Couch's. Dr. Seth E. Meek, another active field ichthyologist, caught and preserved some specimens in 1902 and then there were no more until I made my first collecting trip to Mexico in 1930. At that time I was seeking live fishes for the Cornell University Fish Genetics Laboratory and I shipped back the first live specimens ever brought out of Mexico. That stock was lost in 1937, but two years later I returned to the same region and caught another supply, this time for the New York Aquarium.

That 1939 stock is now, in 1953, in its fif-

teenth generation at the Zoological Society's Genetics Laboratory housed in the American Museum of Natural History. It would be good to report that it seems likely to go on for another fifteen generations, but the fact is that the colony is dying out. One of these days it will be necessary to return to Monterrey and replenish the stock, for when the Monterrey Platyfish is mated with the Common Platy, their hybrid offspring have proved singularly prone to the development of melanomas — showing that heredity plays an important part in this disease. We hope through the study of these tumors to advance our knowledge of the underlying causes of cancerous melanomas, for man is subject to an almost identical malignant and devastating malady.

In 1930 I had no way of knowing quite how important Lieut. Couch's platyfish was to be in the genetical studies then under way, although it was a safe guess that it would be a useful living



tool and naturally I wanted very much to collect it alive. That I was able to do so just then was the merest chance.

For six days I had been fishing for the Monterrey Platyfish in the rivers of northeastern Mexico but with no success at all. Nothing resembling *couchianus* came out of innumerable seine hauls, and on the seventh day I thought I might change my luck by taking a day off and seining the underground pools of the Caves of Garcia a few miles north of the village of Santa Catarina.

My luck certainly did not change immediately, for the pools were just as unrewarding as the rivers had been and we turned up not a single cave-dwelling organism. In mid-afternoon we started back over the dusty road to Monterrey.

Then our Mexican guide came up with a suggestion. There might be *sardinas* — small fishes — in the mountain brooks of the Huasteca Canyon not far away. "And besides, Señor, if you do not find the fish you are looking for, you will, I promise, see some grand mountain scenery."

Scenery palls when one's whole energies are bent on catching an elusive fish, but we had not previously seined the stream within the Huasteca Canyon and no brook could safely be disdained. We turned toward the distant mountains and followed an ox-cart road that twisted through the canyon floor in hairpin detours around gigantic spiny nopal cactus and limestone outcroppings.

**Backwater of the brook — for
is scarcely more than that in
dry season — seemed to be
platyfish's ancestral home.**

The scenery was indeed grand, for violent forces had upended the layers of rock to form an almost perfect example of what geologists call an anti-syncline; rock cones reached upwards hundreds of feet above the valley and dwarfed the river, the vegetation and the people.

The "river" — for it is called the Río Santa Catarina — was at this season hardly anything to boast about. In some spots it was ten feet wide; in most places an agile man could leap across its rubbly bed. Still, one could imagine what it was like in the rainy season, for its banks were strewn with man-sized boulders and with

ponderous trunks of jungle trees, crushed or worn to glassy smoothness by the water.

One quiet backwater of the brook looked promising and I unwound our minnow seine with its quarter-inch mesh and we made a few trial hauls. On the fourth dip we brought up *Xiphophorus couchianus*. I had never seen a living specimen of the fish, but I knew it could not be anything else — an inch-long creature, brown-black above and white below, not too unlike the stiff and faded specimens in museum jars and certainly recognizably different from the other platyfish with which I was familiar.

While this backwater did not appear to be teeming with platyfish, we *had* proved that the fish existed in that particular stretch of the river. I looked around for a better fishing hole and found it in a wide, shallow, spring pool a few yards away. It was choked with *Chara*, a lime-encrusted algal plant, and water sifted slowly through the filaments of the plant and ran down into the river. Such a pool would be an ideal breeding place for platyfish and we tried a seine haul there.

We had, it seemed, struck the ancestral home of all the *Xiphophorus couchianus* in the neighborhood. They were swarming in that pool by the thousands. In one seine haul we collected more Monterrey Platyfish than all the museums in the world contained up to then. In twenty minutes we captured five hundred specimens without causing any observable thinning of the platyfish population darting through the weedy jungle.

How these little fish have managed to persist — for a known period of a hundred years, and probably for hundreds of thousands of years previously — in the path of floods that yearly scour the entire valley floor, I do not exactly know. It may be that the tough and tenacious bed of aquatic weeds protects them when the rains come and the torrents roar through the canyon.

Nine years later, in 1939, I went back to that same pool and repeated the first experience of hauling the Monterrey Platyfish out by the hundreds. As I said, soon I shall have to make a third visit to replenish a stock that has declined in captivity. I confidently expect that there will be plenty of platyfish at the same old stand in the Huasteca Canyon.

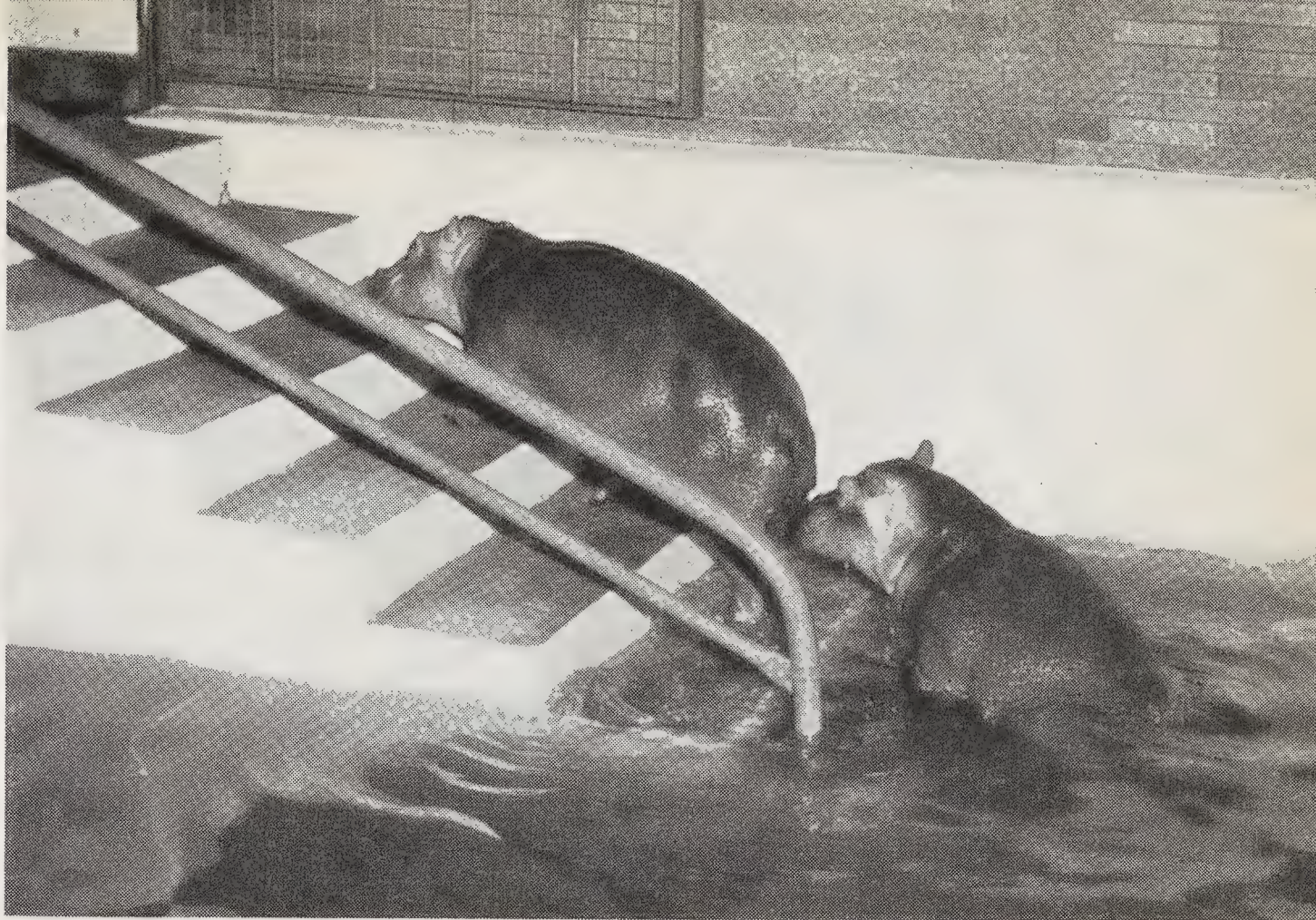
PICTURE ALBUM

PHOTOGRAPHS BY SAM DUNTON



A pair of young Pigmy Hip-
potamuses has just been added
to the collection and is now
on exhibition in the Elephant House.

Wapiti calves are usually born
in the spring, but to our sur-
prise this healthy youngster
arrived in a snowstorm on Nov.



Phoebe, about 18 months old, is the new companion of Peter the 2nd. The baby Hippopotamuses are now in the Elephant House.

Snowy Owls are beginning to go south from the Arctic. This one was captured aboard a ship some 300 miles out of Newfoundland.



FAIRFIELD OSBORN AND PROGRESS IN CONSERVATION

By SAMUEL H. ORDWAY, JR.

ON A RECENT nation-wide broadcast, Fairfield Osborn was asked whether his continuing analyses of the limits of the earth do not make him pessimistic. He answered "No."

"Truly," he asserted, "I continue to be a confirmed optimist." And he is.

Although Mr. Osborn deals with facts which in their aggregate are frightening, because they show the uncertainty of man's destiny, the Zoological Society's President is also in a unique position to see the progress of human understanding and our steadily mounting human effort to reduce waste and misuse of our resources, and to overcome obstacles to the security of all forms of life in this troubled world. Later in this article we will look at some of the hopeful indicators which support Mr. Osborn's optimism; they should give him a particular kind of satisfaction, because his own efforts have been a substantial force and inspiration toward such progress.

But first we may review the evolution of Mr. Osborn's own thinking, and the extraordinary growth of the movement of which he is a leader. The New York Zoological Society has long been concerned with advancing the conservation of wildlife. Madison Grant, Henry Fairfield Osborn (senior) and William T. Hornaday, in their writings and in their espousal of the preservation of habitat and protection of threatened species, pioneered in this field. The Trustees of the Society established a Conservation Committee and provided for special study and effort to increase awareness of the need for conservation.

In "The Pacific World" series, which Mr. Osborn edited in the early 'Forties, his interest in the flora and fauna of regions invaded ever more rapidly by man is apparent in every volume. It was through study of the problems of wildlife that he came soon to recognize the full significance of the inter-relationship and inter-dependence of all natural resources.

It follows naturally that concern for the conservation of wildlife becomes concern for the conservation of all living resources. The Trustees of the Society approved the President's extended historical studies of human pressures on the earth's resources which led to the publication of "Our Plundered Planet" in 1948. At approximately the same time the Trustees authorized Mr. Osborn to organize the Conservation Foundation for concentrated research and educational activity to offset the destructive trend so clearly pictured in "Our Plundered Planet."

At that time there was limited awareness among national and international leaders of the importance and immediacy of the problem posed by the rapid increase of the world's population and the constant decline in the resource base. This relationship Mr. Osborn now calls "the eternal equation" and it is widely recognized as the major problem of our time. The increasing demand for resources is a basic cause of unrest in the world today; it is the hidden weapon of dictators and those who would be dictators, as it is the hidden strength of Communism itself. Until that pressure is relieved we shall not be able to eliminate the danger of recurrent war.

In 1948 the importance of using research ap-

appropriations to increase productivity was little understood by the people of the nation or their appropriating agents in the government. Appropriations were infinitesimal. They are still small compared with national need but their importance is much more widely recognized.

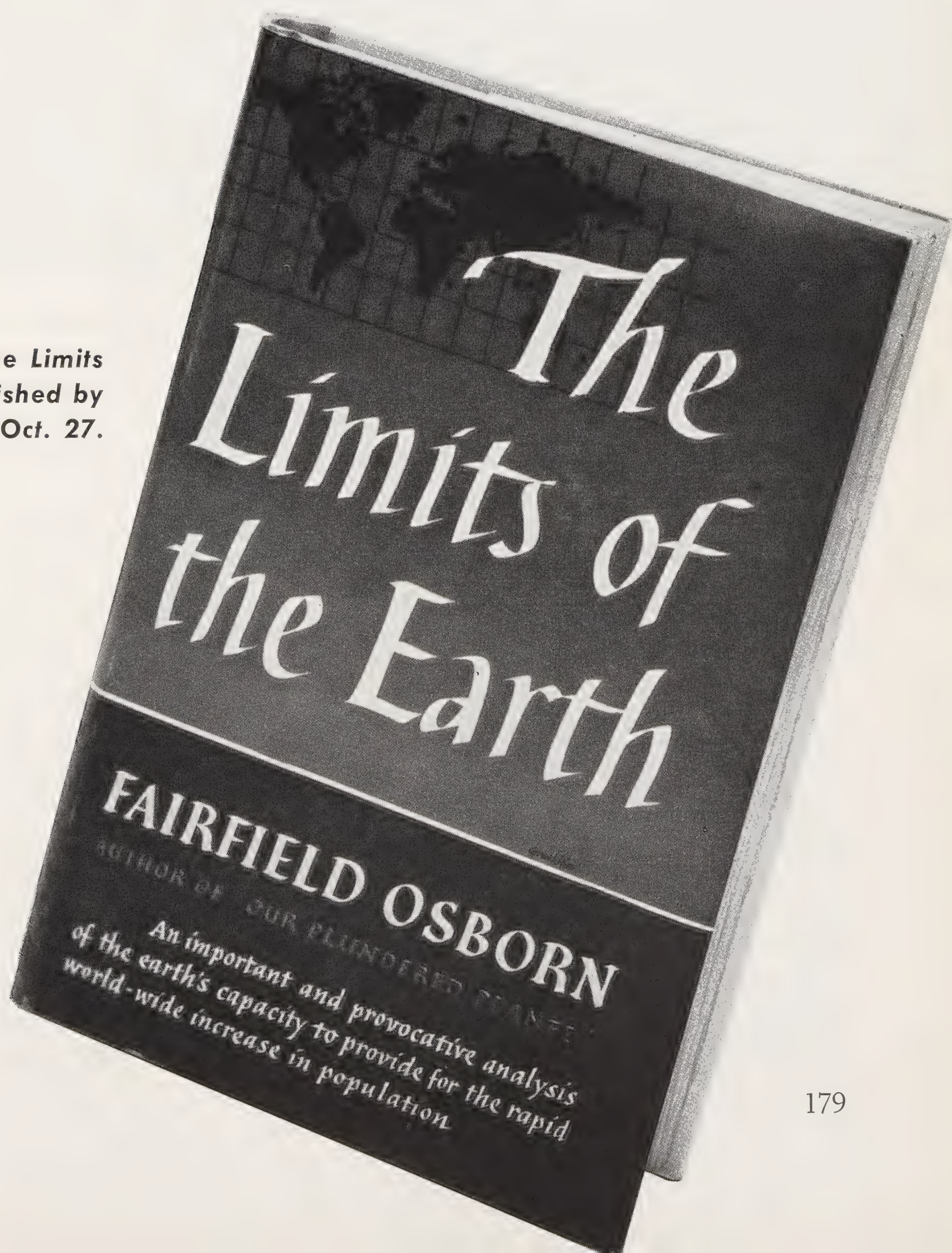
At that time, too, there was much less recognition than today of the importance of conservation education in the schools and universities of the United States, and the public awareness programs of private organizations were quite limited. Now most schools in the country include teaching of resource facts and needs at some point in the curriculum, and the quantity and quality of conservation teaching is growing everywhere. In our universities, Natural Resources and Conservation Departments for undergraduate and graduate study have been established across the nation from New England to

California. Those who have followed Mr. Osborn's efforts know of his leadership in establishing the pioneer department at Yale and his help in initiating graduate study at Harvard of obstacles to conservation practice on the land. Less well known in the East is the outstanding progress made at such places as Michigan, the University of Colorado and in California and Oregon. This trend may be still in its infancy, and certainly much more needs to be done, but the trend has been established and the progress in only five years is certainly justification for optimism.

At the time "Our Plundered Planet" was published in 1948, Mr. Osborn wrote:

The tide of the earth's population is rising, the reservoir of the earth's living resources is falling. . . . The inter-dependence of all the elements in the creative machinery of nature points clearly to the fact that any program devised to meet the situation calls for a supreme

Mr. Osborn's book, "The Limits of the Earth," was published by Little, Brown & Co. on Oct. 27.



coordinated nation-wide effort. Many conditions are involved — social, financial, political, as well as physical. Such a program still is awaiting formulation.

The “conservation climate” of public opinion has been improving steadily. Since the above words were written the President of the United States has appointed two major commissions to examine into the situation of vital natural resources and to recommend major national policy — the President’s Water Policy Commission and the President’s Materials Policy Commission. The reports of these two Commissions are milestones in national history which make possible coordinated nation-wide effort. On the social front, research is under way to ascertain the most practical methods of winning acceptance by all groups and classes of people of the conservation ethic and to accomplish action to transmute technical knowledge into productivity on the land. Research related to the productivity of individual resources is mounting also. For example, substantial federal funds for fish and wildlife research have been made available to state conservation agencies under recent laws.

Great Foundations are more and more stressing the importance of the eternal equation. The Rockefeller Foundation, which has done so much to improve public health and to prolong life throughout the world, is devoting ever more of its grants to agricultural effort. The Ford Foundation has sponsored the creation of Resources for the Future, a fund to advance research and education in conservation. Both the U. S. Chamber of Commerce and the National Association of Manufacturers have created new committees on natural resources and conservation. So has the Congress of Industrial Organizations. From small beginnings the movement is strengthening on all fronts; cause for optimism, but is it enough?

In “The Limits of the Earth” Mr. Osborn has not only marshalled the historical record and current facts about the resources of the overpopulated and undeveloped regions of the world, but he has come to grips with the essential problem of the “eternal equation” — resources in relation to man. He writes:

We are under the power of a timeless principle, exerting its influence relentlessly on a global scale. This principle is closely related to the law of supply and demand. It finds expression in a simple ratio wherein

the numerator can be defined as “resources of the earth” and the denominator as “numbers of people.” The numerator is *relatively* fixed and only partially subject to control by man. The denominator is subject to substantial change and is largely, if not entirely, subject to control by man. If we are blind to this law, or delude ourselves into minimizing its power, of one thing we can be assured — the human race will enter into days of increasing trouble, conflict and darkness.

It is people who are injuring animal and vegetable life by constantly consuming more than the earth can produce.

The problem of population control has always been controversial. Yet it is real. Mr. Osborn shows that in the 19th century, in the short span of four generations or a hundred years, the world’s population almost doubled; and since 1900 another 800,000,000 have been added to the world. All the progress that we have made — in reduction of present misuse of resources, elimination of waste, finding of substitutes and increasing productivity — has not kept up with the increasing demand of this onrush of people seeking ever-higher levels of living. All the progress that we can foresee will not be enough. Mankind has got to find some way to keep the denominator down if the quality of living is to be maintained.

At the end of “The Limits of the Earth,” without fanfare or threats, Mr. Osborn very rationally leads his readers to this final question: “Is the purpose of our civilization really to see how much the earth and the human spirit can sustain?” He answers: “The goal of humanitarianism is not the quantity but the quality of living.”

On the basis of past progress, there seems to be every hope that the rational development of this thought can and will obtain international acceptance and effective action in the years ahead.

Mr. Osborn continues to be a fighting optimist. First impelled by a love of wildlife and study of the basic needs of wildlife conservation, he has progressed to clear recognition that the maintenance and improvement of the natural environment is not enough, that we must also face up to the problem of the pressure of numbers of people reacting upon the environment. There lies the danger to the quality of all life. His leadership confirms today the fact that the ability to be optimistic in the face of danger is the very breath of hope.



Under this ledge a dozen young Alligators of last year's hatch were hiding. Dr. Oliver and Dr. Kazimiroff easily captured them.

In a Florida Alligator Nursery

By JAMES A. OLIVER

WILLIAM BARTRAM, the illustrious naturalist, following the footsteps of his equally famous father, John Bartram, and studying the interesting wildlife of Florida and Georgia, details the results of his studies and his exciting experiences in the well-known narrative, "Travels in Georgia and Florida, 1773-74." Alligators occurred in large numbers and in large sizes at the time of Bartram's travels. They also were bold and ferocious, to judge from some of his harrowing experiences with them.

Bartram's account is one of the earliest reports available on the Alligator's life history. In one place he says:

The Alegator when full grown are generally from 16 to 22 feet in length & the biggest part of their Body, commonly bigger than a 30 Gall. Cask. They lay two or 300 Eggs in litt[l]e mounts in fens & Marshes which they form of mud & rotten weeds & leaves, which I suppose fermenting by the heat of the sun becomes warm enough to hatch their eggs. when the



Young first appear in shallow water not far from the old nest they are about 12 or 13 Inches long, they are perfectly shaped, plated all over, of a beautifull colour. pied all over bright yellow & brown. not much unlike the colour of the Rattle Snake, they are then very active & illnatured[,] opening wide their mouth & snap^g[,] making a noise & barking like a little dogs & switch their tail to their mouth. they keep together in schooles the first year in the same place[.] The Old one either Male or female lies near[,] secreted in the sedge or Weeds to guard & protect the Young[,] who is very watchfull & furious. Thus I have indeavoured to give a description of the horrid & destructive Alegator[.]

Alligators are no longer so abundant nor so aggressive as Bartram found them. The demands for Alligator hides and the sale of the young in the pet trade have had a marked effect on the once vast population of 'gators in the southeastern United States. Thanks to the protection of the present conservation laws, however, the Alligators are making a strong comeback and again

Two hundred feet from the wallow pool and the d of the female Alligator was the mound on the flo of the forest that was used year after year as a ne

becoming a fairly common feature of our southern waters.

Bartram's observations on the reproductive habits of Alligators are of special interest because reptiles are notably lacking in parental care. Yet his description indicates a fairly high degree of parental care for *both* eggs and young. Was Bartram romanticizing the facts, was he merely repeating the beliefs of the natives, or is the Alligator really a model of maternal propriety among the reptiles?

There is no doubt that Bartram was greatly impressed with the size and ferocity of the Alligator, and this probably led to some exaggerations in his reports on this animal. However, in recent years observers have had an opportunity to study the habits of Alligators in more detail and more critically than did Bartram, and the reports of B. Dowler, F. W. True, S. F. Clarke, Albert M. Reese, E. A. McIlhenny, Ross Allen and others

have revealed many details of the behavior of the female Alligator during the breeding period. Their studies have confirmed and augmented the basic facts of Bartram's early account, although a few minor details required modification. We now know that the mother Alligator is virtually unique among living reptiles in the protective care she gives to her eggs and young.

Her post-mating reproductive behavior is strenuous. From the middle of May to the mid-

hole near the edge of the water adjacent to the nest.

The eggs hatch in about 64 days, with the young 'gators measuring eight to nine inches in length, apparently breaking through the shell by means of the hard, horny caruncle on the tips of their snouts. Although they can get out of the egg shells by themselves, the newly-hatched young may be unable to get free of the nest, especially if the mother has packed the top down tightly.



dle of July she builds her nest on a dry bank not far from water. The nest is made of vegetable matter, such as rushes, reeds, leaves, leaf litter, sticks and roots, which she scrapes into a mound two or three feet high and four to eight feet in diameter at the base. After the nest is built, the Alligator digs a hole in the top of the mound and lays from 15 to 88 eggs. She then covers the eggs and packs down the top of the nest by crawling back and forth over it. She may or may not wet down the nest at this time. After the eggs have been deposited and covered the female remains to protect them from hungry raccoons, skunks, opossums and hogs. Usually she remains in a den

Somewhere deep in the flat cave under this ledge of coral the female was probably lurking while pictures were made. A Ranger kept a sharp eye on it.

Their grunting at the time of hatching attracts the guardian mother, who bites or scoops off the top of the nest, allowing the young to crawl out. She leads them to water and protectively shepherds them through the first year of their lives.

This is a very brief summary of the known behavior of the mother Alligator. Because of these unusual habits we were interested in getting motion pictures of nests and young for our "Living Reptile" series of films, and our trip to

Florida last May was made partly with Alligator nesting in mind. We had been in correspondence with Dr. Joseph C. Moore, Biologist of the Everglades National Park, and he asked Park Ranger Erwin Winte to locate some active nests for us prior to our arrival. Ranger Winte, a born woodsman, a keen naturalist and an ardent herpetologists, knew several 'gator nests, but he was not sure that we would find eggs so early in the laying season.

On May 25 the Zoological Society's photographic party followed Ranger Winte through a thick Florida hammock — a woods consisting primarily of broadleaved evergreen trees. This trackless tangle of palmetto, sawgrass, wild grape vines, custard apple and acacia gave way to an old slough that was virtually dry because of the severe drought. Nevertheless, at the eastern edge of the slough there remained a tiny black pool some ten feet in diameter and about two feet deep in the center. This was a "wallow pool" and it harbored young 'gators from last year's hatch.

During dry periods when the water begins to recede, bull Alligators and independent youngsters usually move to larger or more permanent bodies of water, but the guardian females clear out wallow pools in which they remain with

their youngest broods. In the process of excavating such a pool the snout may be used as a scoop and the powerful tail is threshed back and forth to create a strong current that washes away loose mud. In such a deepened pool water will usually remain throughout the dry spell. Fish and other aquatic life remain in these pools and are utilized as food by the baby 'gators. As we approached the well-shaded wallow pool we could see four babies at the edge of a coral ledge that bordered one side. Winte made a high-pitched, grunting sound several times and so accurate was his imitation that the little 'gators responded with squeaking grunts and started to move toward him. Becoming suspicious, they soon stopped short and then disappeared under the ledge. Winte lay down on the coral rocks and, reaching under the ledge, extracted two young 'gators about 16 inches long. Dr. Theodore Kazimiroff and I then tried the same stunt, with the result that in about five minutes we had removed ten young 'gators from under the ledge. We turned them loose again so that Staff Photographer Sam Dunton could get good action pic-

All that remains of the Alligator Swamp during the dry season is this pool 10 ft. in diameter.





A sight that is seldom seen — an Alligator, a female, poised in the entrance to her den and all ready to repel closer approach.

tures of them as they cavorted about in the pool.

When we first caught the little fellows they grunted loudly and continued to do so most of the time we were around the pool. During the whole process Winte was careful to keep a watchful eye in the direction of another ledge of coral some twenty feet away — the female's den. Its opening was nearly six feet across and about two feet high, and in depth it extended more than ten feet. The floor was covered with a thick layer of leaves. We could not see the female, but Winte thought that he heard her once. He felt sure she was in the den by the signs around the opening when we first arrived, but he believed that our talking kept her inside despite the grunting of her young, which would normally have brought her out. Later in the day we saw two of the young near the mouth of this den. During a normally wet period the den would be at the edge of the water, whereas it

was now quite dry and at least a hundred feet from the remaining water in the main slough.

Winte showed us a second wallow pool that had been used in past years by this same female. It was approximately fifty feet west of the first pool, was slightly larger and had a den opening in the water at its south end. There was no sign of any 'gators in or around this pool when we visited it. Winte told us of a third and larger wallow on the other side of the slough. He said that this pool contained two sizes of young, some two and others three feet in length. He considered these to be two and three years old, respectively. This is an interesting situation because it is thought that the young usually leave the

wallow at the beginning of the second year, when rains raise the water level again. Winte doubts that this is always the case.

After we photographed the young in the wallow pool and the entrance to the female's den, the Ranger led us south along the slough to the nest about two hundred feet away. It was a prominent object on the hammock floor, a mound of decaying leaf litter about seven feet in diameter and nearly two feet in height. It was in a well-shaded location and was overgrown with Virginia Creeper, indicating that the female had not yet laid this year. Females frequently use the same nest year after year, merely building up the old mound a little higher, and Winte knew that the same female had used this nest for the past two years. The nest and surrounding ground showed abundant Alligator droppings, a sign that she had spent considerable time around the nest.

I dug into the top of the nest to be sure that there were no eggs and to get a temperature reading within the mound. The temperature of the air in the shade outside was 90° F whereas that within the nest was 95° F. These large mounds of decaying vegetation provide an excellent incubator that keeps the eggs at a fairly constant high temperature. McIlhenny made a series of temperature readings on a nest in Louisiana throughout the incubation period. His data provide an interesting quantitative indication of the effectiveness of such a nest. The daily variation in the air temperature was between 5 and 22° F, with an average variation of 15° F, whereas within the nest the variation was only 2 to 8° F, with an average variation of 3° F. The temperature within the nest averaged 5° F above the maximum air temperature and showed an average of 12° F above the minimum air temperature.

In the afternoon Ranger Winte took us to the fire tower in his section of the Everglades National Park. From the high tower, 90 feet above the ground, we got a wonderful view of the typical glades country — a vast expanse of grass with scattered islands of cypress hammocks. During the wet part of the year the Everglades is literally a sea of grass and transportation through most areas is only by air boat or "glades buggy." Now it was parched, dry, savannah-like — a tinder box under the anxious eyes of the fire wardens. The

fire tower is surrounded by a protective moat approximately 100 yards square, and when the water level drops in this area there is still a good depth in the moat. Alligators congregate here at such times. From the tower we counted sixteen Alligators; some were large reptiles, nine or ten feet in length. We had hoped to observe the courtship activity of these 'gators, since they had been breeding for more than a week before our visit, but on this occasion they were content merely to bask quietly in the warm sunlight.

The next day we stopped to photograph several Alligators in a large slough near the entrance to the National Park. One female had a den and wallow area beside the trail. She had been known to nest near this den the past three years, but had not laid any eggs yet this year. We visited her three or four times during our trip. She usually was lying in the water, away from her den near the nest area. Once when I climbed off the trail and moved toward her nest site, she started swimming in toward me. On a later visit Mr. Dunton made some excellent pictures of her in the den with only her head exposed. In this position she could maintain an alert vigil with a minimum amount of exposure. With the large number of potential predators on the eggs and young, there would be a tremendous loss of reproductive stock were it not for the protective care of the Alligator mother. Even with this prolonged maternal care it is virtually impossible for the brood to come through without some losses due to predation. Her care greatly increases the probability that *some* of the brood will survive.

In the Everglades National Park, Superintendent Dan Beard maintains a rigid policy of protection for all animal life. Thus the animals within these boundaries can live, flourish and die relatively free from human disturbance. As a result of this protection, the Alligator is one of the many larger animals that is becoming numerous again. This is attested by the large numbers of 'gators that we saw in the short time we were in the Park. They are really making an excellent recovery, but it is doubtful that they will ever again be as abundant as Bartram reported them in his day. Even so, in some parts of the Everglades it is already necessary to put up highway signs: "Caution — Alligator Crossing."

News from the Conservation Foundation

Increased Distribution for Conservation Films

Royalty receipts by the Foundation and Society from sales and rentals of Conservation Films by Encyclopaedia Britannica Films, Inc., for the last six months have exceeded those received in any similar period since 1949 when distribution commenced. It is gratifying to know that educational and public use of these films continues to increase despite reduced school budgets. EBF recently reported that more than three million school children are now studying the message of these films each year.

Radio Discussion

President Farfield Osborn recently appeared on a number of radio programs around the time of the publication of his book, "The Limits of the Earth," to discuss the book and the implications of his thesis.

Wildlife in Motion Pictures

In connection with the production of the new series of short educational films by the Foundation, educational advisers have confirmed the Foundation's view that the use of pictures of live animals in educational films dealing with such technical subjects as soil use, water control and timber cutting practices, increases student interest and participation in discussions. The new films will include such animal pictures, even though each is designed to concentrate on a single conservation lesson.

Water Shortages

In an introduction, President Osborn has prepared a challenging opening statement on water shortages for Cecil Ellis's research report, "Fresh Water from the Ocean," which will set forth the findings of his recent study for the Foundation. Since the Ellis report shows that no method of

conversion now known can supply fresh water in quantity for industrial, agricultural and domestic use at a cost which is economical by today's standards, Mr. Osborn emphasizes measures which can and should be taken now to conserve and re-use fresh water supplies and reduce pollution and waste. The 1953 drought re-emphasizes the importance of this subject.

Soil Conservation Service Cut

Conservation organizations throughout the nation are up in arms over Secretary of Agriculture Benson's recent decision to close the regional offices of the Soil Conservation Service and to increase the responsibility of the State Extension Service. The Conservation Foundation, which seeks to maintain an objective, non-political approach, has not taken an official position in this highly political controversy. However, it is the view of staff members who have had personal experience with both the Soil Conservation Service's technicians and the Extension Service's county agents, that the former have rendered more effective service in actually helping farmers to apply conservation practices on the land. The regional offices have supplied valuable, integrated service to watersheds across state lines.

Jamaica Project

Robert Snider, Director of Research, and Dr. Kingsley Davis, Sociologist of Columbia University, left by air for Jamaica during the fall to organize the Foundation's research project to be conducted there this winter, under a special grant for population studies. The object of the study is to obtain statistical data on reproduction rates among different strata of society, and the reasons behind various population trends in Jamaica, and to compare these with data recently obtained in Puerto Rico. Dr. Joseph Stykos will be in charge of the field work once the project is organized.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Jennie May Have Set Record for Tiger Longevity

Extremes of age which some wild animals attain in captivity are generally considered to be greater than those they would normally attain in the wild. The reasons are sufficiently obvious: in modern zoological gardens food is plentiful and regular, disease can be treated and there is an absence of predators.

For Tigers, the span of life would seem to be about twenty years. Unless there is some better record of which we have not heard, a Bengal Tigress named Jennie, for many years in our collection, has established the mark with 19 years, 6 months and 24 days in captivity and a pre-zoo existence of about 12 months.

Jennie came to us on April 11, 1934, and her accession card bears the notation "Under 2 years." We can now be somewhat more definite about her age, for General Curator Emeritus Crandall has reason to recall her arrival. In 1934 he was Curator of Birds. Mammal purchases were outside his usual activities, but it was on his recommendation that Jennie was bought. She was placed in the care of a new and inexperienced keeper, and when he noticed that her canine teeth were barely showing at the gum line, he was heard to comment that the Bird Department had bought a Tiger whose teeth had been worn down or broken off. Actually the canines were just pushing through, and they went on to develop normally.

Having bred and reared so many Tigers in these later years, we know pretty definitely that second canines appear at 11 to 12 months.

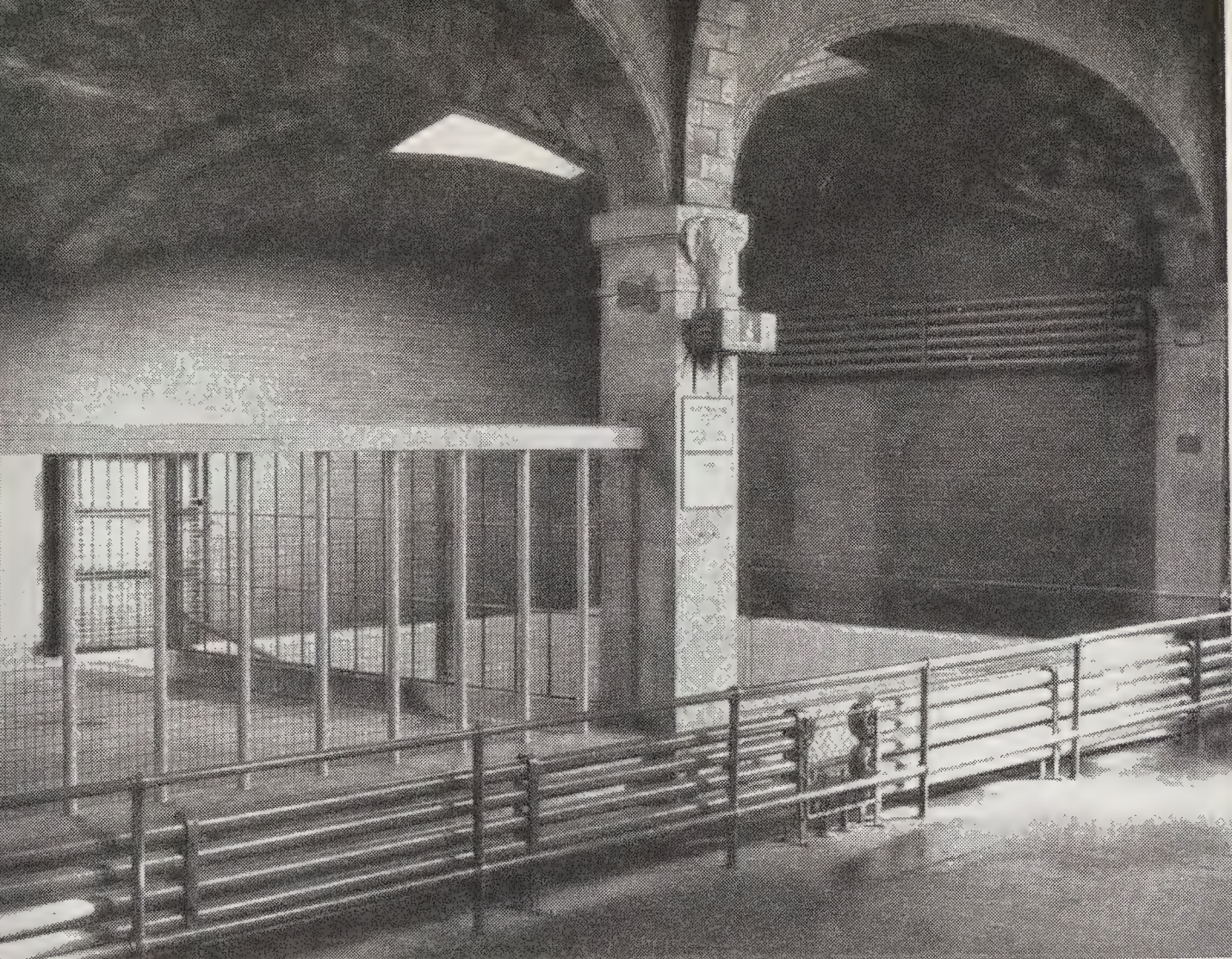
Jennie, therefore, was about 12 months old when she came to us. On December 13, 1948, she was given to the Staten Island Zoo, and on November 4 of this year her health was such that she had to be destroyed.

Jennie's only other claim to fame is that she was the mother of Dacca, Rajpur, Raniganj and Ranee, all four now in our collection, thanks to hand-rearing by Mrs. Helen Martini. Jennie was not a good Tiger mother herself, but Dacca has been exceptionally good and has so far had 21 cubs and has successfully reared 19 since her own birth in 1944. — W. BRIDGES

Plenty of Snakes Are Awaiting Reptile House Re-opening

Recent reptile arrivals include a rather spectacular assortment of snakes and five unusual frogs. Four large King Cobras — the largest measuring more than fourteen feet in length — were received from Bangkok, Thailand. From Durban, South Africa, came an interesting group of cobras and our first Black Mamba in more than a decade, a sleek seven-foot individual. The cobras included two large Yellow or Cape Cobras, two Egyptian Cobras, and two spitting Ringhals. Also in this shipment were two specimens of the highly venomous, rear-fanged Boomslangs. Through the kindness of Dr. Beebe's friend, Mr. James Gibson of Trinidad, B.W.I., we received a handsome 7-8 foot Bushmaster and a small Fer-de-lance. With the addition of all of the snakes to our growing collection we now have one of the best assortments of snakes that we have had in years — all awaiting the re-opening of our Reptile House early in the spring of the coming year.

The unusual frogs are specimens of the rare Surinam Toad. These were brought to us from Dutch Guiana by Charles Cordier. This toad is specialized for life in warm, muddy water. It has an unusual form for a frog and the female is of special interest because she carries the developing eggs and young in separate pits on her back. These are the first of this species that we have had since 1942. — J. A. OLIVER



Our new Hippopotamus stall and pool in the Elephant House. The bars have been lowered at left, removed entirely from the pool.

ZOOLOGICAL PARK MISCELLANY

Another winter of field work is starting for the Department of Tropical Research. Dr. William Beebe, Miss Jocelyn Crane and Miss Rosemary Kenedy sailed on November 13 for Port-of-Spain, Trinidad, B.W.I., to resume their work at our station at Simla. Henry Fleming left at the end of the month by air. . . . Summer-operation-only activities have been closed for the winter. The Farm-in-the-Zoo and the Casting Pool closed on November 1, Question House on November 8 and the Children's Zoo on November 15. The Farm reports the extraordi-

narily high attendance of 79,107 visitors, second only to 1943 when 88,858 persons visited it during a season that ran eight weeks longer than this year. . . . Dr. Myron Gordon, the Aquarium's Geneticist, addressed the Sixth Annual Meeting of the Detroit Institute of Cancer Research. He spoke on hereditary influences that may lead to cancer development, particularly melanomas in fishes. . . . The Voice of America, the Government broadcasting service, has made recordings in the Zoological Park for broadcast in Hindustani and German. . . . Dr. William Beebe was the recipient in November of the Theodore Roosevelt Medal for Distinguished Service. — W. BRIDGES

PUBLICATIONS OF INTEREST

LAND BIRDS OF AMERICA. By Robert Cushman Murphy and Dean Amadon. Illus. by 221 photographs in color and 43 in black and white, by Eliot Porter, Hal Harrison, Allan and Helen Cruickshank and others. 240 pp. Pub. by McGraw-Hill Book Co., New York, 1953. Price \$12.50.

In this ambitious volume, the knowledge of two of America's leading ornithologists and the skill of more than thirty nature photographers have combined in a production that will have great popular appeal. The text is essentially informal and anecdotal in treatment yet provides adequate and authentic coverage of most of the land birds of this country. An introductory section of seventeen pages surveys the general history of the study of birds, including their place in art. On the latter subject there is a wealth of delightfully arguable statements which cannot be considered here. It must be said, however, that while many of the color photographs are superb in both execution and reproduction, a purple Bald Eagle, a blue Oven-bird and a muddy Chukar — to name only three — offer but feeble support to the authors' claim that color photography is the outstanding medium for bird delineation. Until photographer, engraver and printer can achieve more perfect accord, agreement on the point must remain in abeyance. — L.S.C.

WAYS OF MAMMALS. By Clifford B. Moore. Pp. viii + 273. The Ronald Press Co., New York, 1953. Price \$3.50.

In this sprightly volume, Mr. Moore recounts a great number of superstitions, legends and erroneous beliefs concerning mammals, extending from antiquity to the present day. In each case, rational explanations, as far as they are known, are given, so that the book is not only entertaining but a source for sound and authentic information. An excellent list of cited literature, a bibliography and an index complete the usefulness of the work. — L.S.C.

PHEASANT BREEDING AND CARE. By Jean Delacour. 42 illustrations in black and white from photographs and drawings. Pp. xiv + 98. All-Pets Books, Inc., Fond-du-Lac, Wis. \$3.00.

Charles F. Denley's "Ornamental Pheasants, Their Breeding and Care," long out of print, has been edited and amended by Captain Delacour, so that it now becomes an authentic and useful practical handbook of pheasant culture. Included are a brief guide to the various groups of pheasants, with directions for housing and feeding breeding stock, incubation and rearing. Pheasant diseases have been covered by Dr. Erwin L. Jung-herr and Mr. W. F. Grimmer is credited for assistance in the section on the propagation of game pheasants. Altogether a great deal of sound information in condensed form. — L.S.C.

BIRDS AS INDIVIDUALS. By Len Howard. Foreword by Julian Huxley, introduction by Roger Tory Peterson. Illustrated by 32 photographs in black and white by Eric Hosking. Pp. 219. Doubleday & Company, Inc., Garden City. Price \$4.00.

"Bird Cottage," the author's Sussex home, is a rendezvous for the local birds, which use it much as though it were their own. In terms of unique intimacy, Miss

Howard has been able to record their behavior in great detail, with notes on more than fifty resident British species. As Julian Huxley suggests in his introduction, behaviorists will be unable to accept many of Miss Howard's interpretations. Factually, however, the book outlines an approach of great promise which few, unfortunately, will be able to follow. — L.S.C.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1953)

Contributing

W. C. Arkeil
J. L. Bradley
Ernest B. Dane, Jr.
John W. Gregory
Jaime Llavallol
Edward K. Newton
Dr. Samuel Schecter
Saul Waldman

Annual

Miss Patricia Batlan
Martin Birnbaum
Edward E. Booher
Col. Edward F. Brown
Miss Florence E. Day
Henderson Emanuel
Paul D. Germond
Mrs. John Hoffmann

Harry A. Hyman

David D. Jacobus
Charles Kanuk
Mrs. Berthe O. MacLaury
Mrs. Clyde B. Osborn
Miss Evelyn Quick
Miss Catharine Raymond
Howard D. Shookhoff
Ulysses D. E. Walden

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NEW YORK ZOOLOGICAL SOCIETY



VOLUME LVII
JANUARY TO DECEMBER, 1954
NUMBERS 1-6

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ANIMAL KINGDOM

Bulletin of the
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Vol. LVII FEBRUARY 1954 **No. 1**

The Realities of Progress

AS WE LEAVE ONE YEAR BEHIND and begin another the extraordinary variety of activities of our institution strikes one anew. That our work contains many contrasts is not actually surprising because it is dedicated to the animal kingdom whose countless aspects of form and meaning are virtually beyond human comprehension. It so happens that the Zoo itself, with its animals of widely different kinds, provides a symbol of the numerous facets of our fields of interest. For instance, the largest animal in the Zoo weighs more than 3 tons, the smallest less than a penny. Yet this symbol is purely a physical one and therefore too limited because our purposes extend into seeking further knowledge regarding the "ways of life" of animals, into varied programs of scientific research, into wildlife protection and the conservation of the earth's living resources, and, finally, into the crowning purpose of all — providing recreation and education to the public.

Each year seems to bring its own particular, sometimes exciting, developments. 1953 was good to us. Plans for the building of the first stage of the new Aquarium were completed through the generous help of our Trustees and of the City. The site of the Tropical Research Station in Trinidad was deeded to the Society by its faithful and gifted Director Emeritus. Effective research work continued apace. The Zoo was further modernized. An outstanding project in wildlife protection, resulting in the publication of the book, WILDLIFE IN ALASKA, was completed. Receipts of membership dues reached an all time high. Educational activities were somewhat increased. True, Penelope, the tantalizing platypus, disappointed a waiting world, but perhaps her "shining hour" is yet to come. All in all it was a good year.

What of 1954 and on? So much, so very much, will depend upon the support given the Society by its members and friends. It is one thing merely to maintain the status quo and continue in reasonable financial health. It is quite another to grow in accomplishment, and to meet, with vitality, the unfolding opportunities that lie ahead. Our organization is privileged to work in a unique field of interest and service. Only with the faith of our members and friends, made tangible by generous financial aid, can our institution do justice to its future.

Fairfield Osborn

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The Story of a

Curious Caterpillar

This is the story of a caterpillar which, from her own body hairs, fashions a complex defensive series of traps. These serve as a protection during her coming transformation into a chrysalid, of which she knows nothing. Man copies this method of defense when he fastens a circle of tin halfway up a hawser stretching from ship to shore, as a rat-guard to prevent the passing of rodents.



By WILLIAM BEEBE

THE FULL LIFE CYCLE, on the earth, of a moth or a butterfly, may be encompassed in four words — egg, caterpillar, pupa and adult. To be technically exact, this sequence is not precisely a circle, but rather a very flat spiral, for from egg to egg there must be some infinitesimal change, plus or minus. This variation may be ultra-microscopic, it may be lost in the next reshuffling of genes, but it must exist, for not otherwise can we have evolution.

The cycle is far from being a smooth passage through time and space, for in its course there are vital crises. The methods of meeting and overcoming these crises occupy considerable of our attention in our behavior studies at the Department of Tropical Research station at Simla in Trinidad. To explain their origin and development would advance us several steps on the road

to deeper knowledge of the inner workings of evolution.

The mature female moth or butterfly, to justify her existence in the race for life and to prevent the extinction of her kind, must overcome three major hurdles. She must avoid danger (witness honorable wing scars left by the futile snap of a bird's beak); she must obtain food (requiring a preknowledge, somehow handed on through egg and caterpillar, of correct color or right scent, leading to the hidden nectary); a mate is prerequisite to continual existence (to be perceived amid the surrounding world of life in field and forest, to be recognized and submitted to).

Finally, by some inexplicable prophetic instinct (whatever that means) the parent moth must anticipate the correct sustenance of her future offspring; the egg must be deposited on the par-

ticular and suitable leaf or blade. Egg after egg may be laid with only this dietetic safeguard, or an exceedingly complex mechanism may be provided for the future protection of the young larva.¹

The actual hatching of the average caterpillar presents no immediate physical hazards, for, having spent a few days within a beautifully fluted egg, on emerging the larva proceeds with the greatest possible speed to reverse the process and place the egg-shell within its own, less artistic self. Following this, it finds vegetative nourishment ready at hand for its stout jaws.

The caterpillar is not bothered with problems of sex, for while already pre-ordained to ultimate male or femaleness, yet in its short, larval phase of life it has all the advantages, together with the unenviable futility, of temporary sexlessness.

On the other hand, escape from danger is an ever-present necessity, and daily and hourly existence is plagued with the boogies of "early birds" and still more sinister parasites. Its ganglionic instincts impel cryptic poses and display of pigments — inclining to gray lichen hues if it be readily edible, or flaming scarlet and yellow if life fluids are adulterated with acidity. Or it may simulate a twig or develop a brave attempt to look like nothing. It may even climb up its own pellets to escape inimical appraisal.²

All these are commonplace facts, but they are also commonplace miracles. At this moment, upon our earth, metamorphoses are taking place in something like a million of species, and billions of individual insects. So it is not unwise to have them recalled, now and then, to our consciousness.

The supreme crisis in the life of a caterpillar comes, as with ourselves, at the apparent end of its active life. It must prepare to become a mummy. Resurrection, to a caterpillar, is such a certainty that it does not have to have faith; in fact, it has nothing to have faith with. Its actions speak for themselves and in these preparations instinct never more effectively masquerades as intelligence. In pseudo-ingenuity the child caterpillar equals the performances of his parent. One of these cases has been observed, and is the subject of this paper.

ON THE TENTH of February a caterpillar was brought into the laboratory at Simla. It was a very small creature, about one-third of an inch long, undistinguished in grass green and black. The chief thing in its favor was that we knew its food plant. It was feasting upon a blade of grass, or more definitely, the leaf of a black-and-white Trinidad sedge, and this plant grew in abundance in damp places on the forest floor.

Human eye-sight being the poor thing it is, we focussed the larva into a higher bracket of visibility, revealing the forbidding aspect of the sedge leaf. Considered as baby food for a small caterpillar it resembled rather a double-edged cross-cut saw with serried rows of sharp, silicious spines. Yet the little being was tucking it away with ravenous speed.

For exactly one month, the caterpillar ceased eating only for sleep, whatever such open-eyed periods of quiescence may mean. As it ate, it grew, and five times it shed its skin, slipping out of a tangled mass of hairs and spines. Lacking broken glass, the larva turned around and devoured every bit of the ill-favored fodder. A Frenchman would have defined its digestive powers as *formidable*.

On the morning of the last day of its active existence, the larva chewed, swallowed and digested five inches of stem in two hours. In the afternoon it absorbed still more of the spiny chlorophyll, and then rested. At eight in the evening there was no change but at nine we discovered two symmetrical whorls of hairs surrounding the stem, well below the larva.

The caterpillar was now more than an inch in length, black, with two pale yellow side lines, while the fore and aft segments were decorated with a tuft of black, and numerous long, slender hairs, with curved tips. We now know it for the larva of a species of day-flying moth, with the euphonious family name of *Euchromidae* — the Well-colored Ones. To offset the dangers of life in bright sunshine many of these moths have been able to assume the colors and shapes of ill-tasting beetles, flies and wasps.

Here we have a normal egg, hatching into an ordinary caterpillar, feeding and molting as usual, but succeeded by the mystery of the two whorls of hairs. This creature had initiated something extra-ordinary, something beyond the mere spin-

¹ Miracle of the Palisade Bell Moth. *Animal Kingdom*, June, 1948, pp. 76-79.

² Life History of *Colobura*. *Zoologica*, 37:16, pp. 199-202.



**This caterpillar of a day-flying
chromid moth is full-grown at
length of about an inch. It is
now ready to become a chrysalid.**

(Photographs by Rosemary Kenedy)

Before transforming, the caterpillar pulled out the long hairs and arranged them in a series of guarding whorls around the stem.



ning of a cocoon. The facts are apparent. The method and purpose are our objective.

As I have said, at nine in the evening the caterpillar was on the sedge stem, fronted with two whorls of hairs, and was busy weaving with head and forebody. All movement ceased in the glare of electric light. It worked only in darkness, so we made artificial night. To a flashlight we fitted a red filter, and from now on the caterpillar labored as in total darkness.

It crawled some distance up the stem and began a series of violent contortions. It rubbed its head sideways, back and forth, pressing down and massaging against its back the long hairs on its forebody. It twisted around laterally in a tight circle, squirming as if in torment.

Then it began to move its head about a definite

area on the stem, and through a lens I could see the spinneret busily at work, covering the stem with a coating of silk. Entangled was a multitude of minute, yellowish, viscid drops. Suddenly the larva reached around and the mass of long thoracic hairs was bent far forward. It seized a single hair, the mandibles slid down to the base, then up again a short distance. Here a firm grip was taken and with a strong pull the hair was uprooted. Thus a short extent of hair base projected beyond the mandibles.

The hair was pressed against the stem at the selected point and held in place by the sticky

silk, while more adhesive wrapping was added. Another and another hair was pulled out and added to the whorl, until about twenty radii were in place. The first three or four were at right angles to one another, then the interspaces were filled in, the slightly overlapping bases forming a firm foundation. When the whorl was completed, a half dozen guy lines of silk held the whorl firmly attached to the stem above, thus counteracting any sagging due to gravity. In addition, the spokes themselves were bound together by a horizontal spiral of web, spider-fashion. The first whorl under observation was completed in fifteen minutes. Then the small creature rested.

The caterpillar erected its chevaux-de-frise in alternate fashion, first one whorl below, then

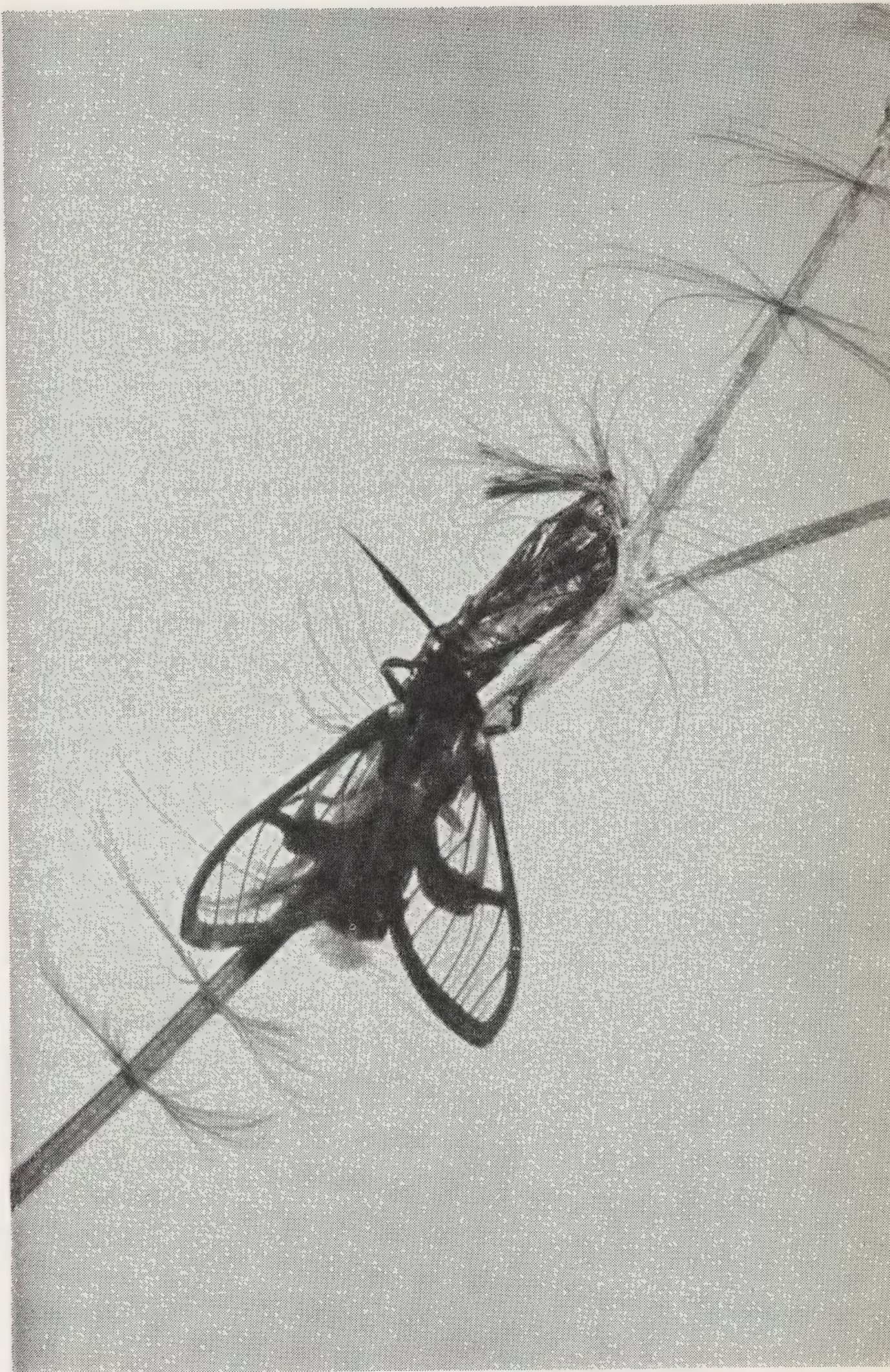
another above, gradually fencing itself on the stem into a slowly contracting area. When the final whorl was in place, there was left just sufficient room for the larva to weave a half open hammock in which to suspend itself in preparation for its next phase of existence. This open-work cocoon was inconspicuous; it might have been a bit of debris casually caught against the stem. To increase the camouflage, the caterpillar plucked forth the two black, tuftlike brushes of hairs and fastened them at head and foot of the chrysalid sarcophagus, as if a plume of winged seeds had lodged there.

The activities of Operation Whorls, as observed by us, began at nine in the evening. At three in the morning the complex work seemed finished, and three hours later, at six o'clock, the larva had made no further move. Throughout the night I had kept continuous watch, and whenever a new phase of activity became apparent I summoned my associates, to examine with the aid of the red filter and a hand lens the details and the progress of action and to verify every part of the performance.

The method of the complex defense mechanism was clear. The object seemed equally apparent; the whorls were obstructions to prevent any marauding enemy from approaching the chrysalid either from up or down the stem. Man uses an identical apparatus when he attaches a circle of tin halfway up a hawser fastening a vessel to the pier, to prevent the passage of rats up the rope.

Within a few hours the larva shed its skin for the last time and became a pupa, an immobile chrysalid. For ten days it lay in its hammock of silk and hair, outwardly motionless, while within, the surge of hormones worked unceasingly, changing a worm into a moth. On March 21st the delicate imago emerged, with transparent wings outlined in black scales, a thing of beauty and of the air, whose food was nectar, whose ultimate destiny was to deposit eggs on the stems of sedge, and whose man-made name is *Aethria carnicauda*. So the life cycle is complete.

What a comparison with the alter ego of this moth; the sexless, wormlike caterpillar, which, thinking only of the safety of its coming entombment, laboring in the blackness of the night, guarding against gravity, denuding its own body



Out of the chrysalis comes the adult female — a delicate creature with transparent wings — whose function it is to feed on nectar and in due time to deposit eggs on stems of sedge.

of structures and turning them into defense stockades, working cunningly with silk and glue, estimating distance and elevation, stress and strain, all with a definite purpose in mind! Such is the anthropomorphic point of view. The truth is that all this labyrinth of activity was initiated and completed at the urge of blind instinct, stimulated by omnipotent hormones, with no slightest aid of conscious realization or intelligence, all directed by an inherited unreasonable knowhow.

Dasypeltis-

LITTLE SNAKE vs. BIG EGG

By CARL GANS

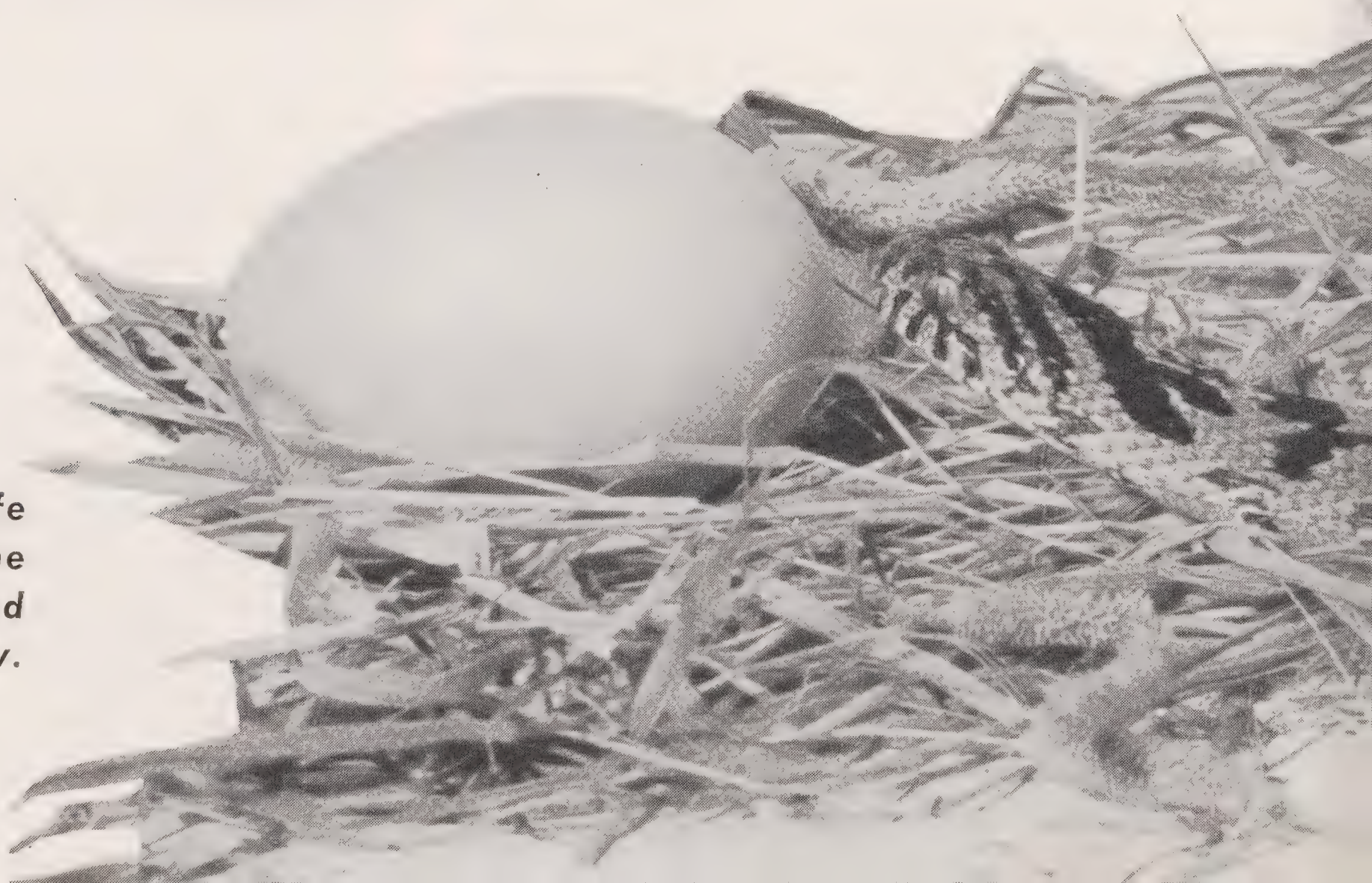
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MAN IS NOT THE ONLY CREATURE that relishes eggs. If our consumption of hen's eggs is not strictly "predation" on the hen, there are plenty of other animals whose relation to birds' eggs is that of predator. Red Squirrels, Rats, Opossums, Skunks, Crows and Bluejays are all fond of eggs, although they are merely a supplemental and seasonal food item. There is one animal, however, so completely specialized for egg-eating that it is almost incapable of eating anything else; it is *Dasypeltis*, the African Egg-eating Snake.

Offhand, it would seem that an egg is just about as awkward a food object as a snake could possibly attempt to eat. And so it is — for snakes, other than *Dasypeltis*, that eat eggs only occasionally. To watch a Blacksnake, for instance, struggling with an egg on a smooth floor is to be reminded of the old game of bobbing for apples. Time after time as the open jaws come down on the egg, it skids away. The sharp and backwardly curved teeth are effective instruments for

holding soft-bodied prey and pulling it into the mouth by means of the independently activated sides of the upper and lower jaws, but they are of very little help when it comes to seizing a hard and slippery egg. It can usually be grasped only if it is pushed against some obstruction or perhaps a coil of the body. Even this requires considerable juggling and the size of the eggs which can be swallowed by this method is very definitely limited by the size of the snake's head.

It might reasonably be asked why snakes don't avoid all this trouble by merely breaking the egg and lapping up the contents. Unfortunately, a snake's tongue functions solely in relation to chemical perception and cannot be used for lapping. And egg fluid is generally much too viscous to be suitable for a snake to drink. The only practical method lies in swallowing the egg whole.



This photograph is nearly life size and dramatically shows the disparity between the snake and the egg it is about to swallow.

Normally when a snake swallows live prey, the food is extended and distorted into a long, thin bundle that is easy to swallow and to store in the stomach. Obviously a snake that crushes an egg in its mouth is going to get egg all over its face, and so an egg is usually swallowed whole. It remains intact in the stomach until the digestive juices have weakened the shell sufficiently for it to be broken easily, or it may be broken immediately after swallowing, by muscular contraction or by pressing the distended area of the body against some hard object.

Even after the contents of the egg have become available as food, the shell continues to pose difficulties to the snake. It takes up valuable space in the stomach until it is completely digested. Thus it would appear that only a fairly large snake can make a successful career of eating eggs by this method.

It is, then, rather surprising to find that *Dasypeltis* rarely reaches a length of three feet, and that even a large specimen capable of swallowing a goose egg has a body no larger than a man's middle finger.

It is the special equipment and the "know how" that makes all the difference. The Blacksnake, you might say, is a poorly equipped amateur; *Dasypeltis* is a superbly equipped professional egg-eater.

The most striking difference between *Dasypeltis* and other snakes is that *Dasypeltis* has almost no teeth — only a few tiny ones in the very rear of the lower jaw. Where other snakes have their backwardly-pointed teeth, the Egg-eating Snake has a series of thick folds of gum tissue, and the

entire lining of the mouth is arranged in accordion-pleated folds. The folds of gum tissue act as little suction cups on the smooth egg surface, while the purpose of the pleated tissue is of course to allow the snake to open its mouth in an extremely wide, egg-encompassing gape without splitting itself "from ear to ear."

Another modification that allows *Dasypeltis* to open its jaws enormously wide concerns the scales on the head. In most snakes, the large scales of the lower jaw are usually divided into two groups, each fixed fairly closely to one or the other of the separately-moveable lower jaw bones. In *Dasypeltis* the scales are only loosely attached to the bones and thus the jawbones can move without unduly stretching the scales, which remain in a close bundle. Instead, the gum connecting the scales to the bone is arranged in loose folds — letting the jaws actually "leave" the scales during the gape.

To let them swing this way, the jaw bones are hinged differently from those of the more familiar snakes. Besides this there are tendons — veritable control cables — that automatically rotate the jawbones during the gape and always present their "strongest side," which also bears the suction folds, to the egg.

All this explains how *Dasypeltis* can manage to get an egg, even a very large egg, into its mouth. The specialization that takes over at that point and enables the snake to collapse the shell so neatly and efficiently is even more striking and is only now more or less completely understood.

The habit of *Dasypeltis* of feeding exclusively on eggs has been known for a long time — Lin-



naeus in 1754 described some of its peculiarities and noted that it had "Dentes nulli" — but it is only recently that we have learned what really happens when the egg is in the mouth.¹

Behind the snake's mouth comes the esophagus, and then the stomach. In other animals the esophagus is merely the tube that connects the mouth and the stomach, and is quite devoid of any hard structures. Not so in *Dasypeltis*; its esophagus contains a series of bones that are actually modified projections of the spinal column. Some have runner-like keels, those of the next group are heavy and egg-shaped knobs, while the last half-dozen or so look like sharp,

¹ Gans, Carl. The Functional Morphology of the Egg-eating Adaptations in the Snake Genus *Dasypeltis*. *Zoologica*, 37 (18) : 209-244. 1952.

**The egg is in the esophagus
throat muscles push it backw
The rear of the neck is bent s
to bring the spines into p**

**The jawbone seems to leave the
scales of the chin region. Note
the suction folds, visible along
the edge of the protruding jaw.**





forward-pointing spines. These projections from the spinal column are technically called hypapophyses.

Back of the hypapophyses and just before the heart is encountered, the esophagus is pinched together to form what appears to be a valve between the gullet and the stomach.

It is all very peculiar and un-snake-like, and it is not to be wondered that earlier investigators were puzzled by these bony projections. Some suggested that they were really teeth, compensating for the almost total lack of teeth where snakes usually have them. Since teeth almost always have a covering of enamel, these "teeth"

were said to be enamel-covered — even though they demonstrably are not. There was even more speculation about their function, and it has been variously reported that they are used to cut, bisect, or even saw the eggs after they have reached the snake's esophagus.

What really happens is much simpler. The egg moves down the esophagus, sliding down the runner-like keels. These not only ease its path,

The shell broken now, the egg is being emptied through the stomach valve. The neck is pinched in front, stopping forward flow.





The end of the process is the ejection of the shell, collapsed and in a neat package. It is easy for the snake to eject, and the contents have been squeezed down to the last drops.

but are also a remarkable adaptation for preventing the ribs and backbone from being bruised by the ungainly package. With the same efficiency the stomach valve will always stop a swallowed egg before it can slide back far enough to squeeze the snake's heart.

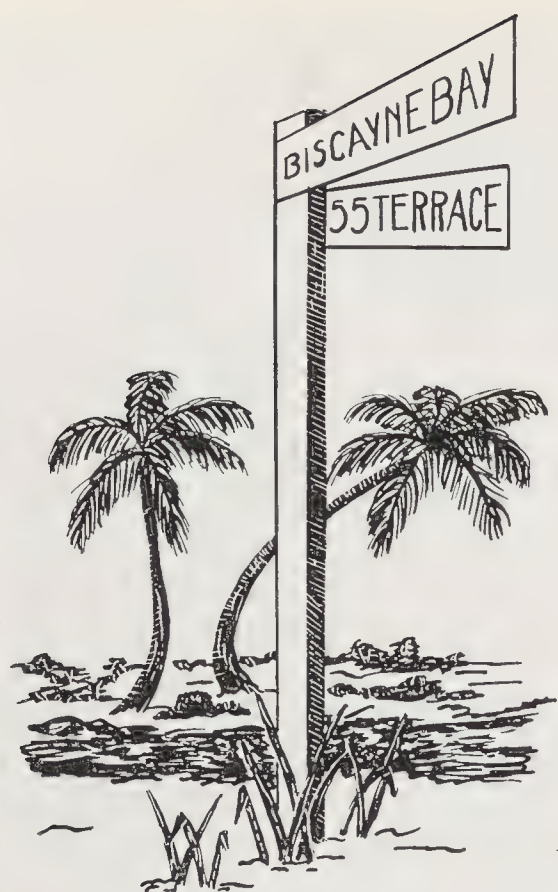
Before the egg reaches the end of the slide, the snake bends sharply so that the sharp spines jut out into the egg's path and can pierce it as it rams into them. Little force is required for this, because — as any cook knows — it is much easier to break an egg against the sharp edge of a pan than between one's fingers.

Ripped open on the spines, the egg now spills its contents through the valve into the stomach. A set of special muscles has closed the throat forward of the egg and there is no place for the

contents to go except backward. The heavy knobs now come into play and squeeze down upon the shell. As the egg empties the same knobs roll up the sides of the shell so that it is packed into a compact bundle that can be regurgitated without trouble.

When the snake has squeezed out all the fluid, it closes a valve before the stomach, gives a few wiggles and out pops the shell from its mouth. The contortions accompanying this ejection are sometimes quite spectacular. The snake may jerk back and forth and even roll over. It generally gives the appearance of being in great trouble. No wonder a special valve was provided to keep it from upchucking its food at the same time!

Shell ejection is an extremely important feature of the economy of the snake. Since it can fill up with straight egg-fluid, and does not have to bother with the by-product of shell, it can gorge itself during the two African bird nesting seasons. The fat stored up at this time lasts the reptile as food during the remainder of the year.



Want to See a Florida Manatee?

By JOSEPH C. MOORE

Park Naturalist, Everglades National Park

AMONG THE RARE and interesting tropical animals which the Gulfstream climate of the southern tip of Florida supports, the sea cow or Manatee is not only the largest but one of the most mysterious in its way of life. We can almost count on the fingers of our two hands the known facts about the home life of our population of Manatees in south Florida. That some numbers of a marine mammal seven to twelve feet long can inhabit populated areas of the United States and keep their private lives virtually unknown to man is a preposterous fact in itself. But they do. Serenely dozing on the river bottom most of the day, some of our wild sea cows live in the Miami River in the very heart of downtown, metropolitan Miami. Thousands of people stream across ten or twelve bridges over this little river every day and hundreds of windows in residences, business places and hotels look down upon the narrow ribbon of its surface. In addition scores of pleasure boats daily follow the narrow channel between their docking spaces and the open freedom of the bay. But who sees the drowsing Manatee rise to breathe? Watchful boat captains, interested bridge attendants and the handful of people who dangle fishing lines from one of the bridges — these people sometimes do.

One reason why so few people see the Manatee is that the waters of the Miami River are almost never clear, and the animal is visible only when it is at the surface. In my observations of wild Manatees I have found that they rarely stay at the surface any longer than it takes to breathe, and they spend at least ten times that long below.

Consequently, although you may watch the water surface sharply while walking across a bridge, the chances are probably worse than ten to one against seeing a Manatee, even if one is there. The rare person who crosses the bridge afoot and takes time to arrange his forearms comfortably on the rail to watch for half an hour or more is apt to have better luck.

When we have visitors who would like to see a Manatee, a convenient place to go is out Biscayne Boulevard to 55th Terrace. Where 55th Terrace dead-ends on the shore of Biscayne Bay about three blocks east of the boulevard in a pleasant residential district, you can sit comfortably in your car and watch for the sea cows to rise and blow. About fifty yards straight out in the water from the end of the street an 18-inch waste water pipe opens at the bottom. This creates a considerable cloudiness or turbidity in the salt water and a usually noticeable "slick" on the surface. I suspect that the Manatees come to this place to drowse during the day because of some protection which the turbidity affords, perhaps protection from the sun. Usually someone is already waiting at the end of 55th Terrace to view the sea cows, or people fishing from the sea wall can report whether or not the sea cows are there. On one occasion when I visited this place, a kindergarten teacher had brought her class to see the Manatees. You may have to wait 12 or 15 minutes to be sure whether a sea cow will be seen, for very large ones may remain submerged that long.

What little we know about the sea cow's way of life is largely inferred from examinations of



Because of the strangeness of their form and habits, Manatees are well worth seeking out in Florida. These are young Amazon Manatees, distinguished by a strong white mark on belly.

the few specimens that have come into the hands of interested biologists, and from rare accounts of their behavior in an aquarium tank. This strange creature, shaped like a fat cigar, has but two limbs. These are small, short, paddle-shaped front flippers set very close to the neckless head. It possesses no hind limbs at all. The body tapers to a thin, flat, broadly rounded tail like a spatula. Up and down motion of the tail provides the power by which the sea cow swims. How different its locomotion from that of the four-legged land mammals from which it has descended! But as a relic of its ancestry, the sea cow still has hair (sparsely scattered bristles), and three finger nails on each of its little forelimbs.

Because of the rapid settlement and development of Florida in the past forty years, Manatees have needed protection, and Florida law has provided a \$500 fine or three months' imprisonment for any person convicted of killing or capturing

a Manatee in Florida waters without permit. This law may have been indifferently enforced occasionally, but it has unquestionably saved the Manatee from destruction by vandals and meat-hungry commercial fishermen.

A scattering of Manatees have survived in the labyrinth of waterways which masks the effluence of the Everglades on the southwest Florida coast. During the six years since this area became the Everglades National Park, the animals have found complete sanctuary enforced by vigilant park rangers. These remnant herds remain wary and wild because commercial fishermen who lived in this wilderness pursued and slaughtered them for meat. It may be several years before they relax enough to permit visitors to count upon seeing a Manatee during a one-day stay in the park. At the present time you can cruise for days through the maze of waterways among the jigsaw-puzzle islands and look in vain for a sea cow. With luck, however, you may see a series of up-boilings on the surface of the water, appearing successively farther away in a line. These are made by the powerful up-and-down motion of the swimming sea cow's tail. By watching and

following the line of up-boilings, you may be rewarded by seeing the creature put up its snout to breathe.

On winter mornings after especially cold nights, the big mammals congregate in shallow, turbid waters at several places in the Everglades National Park. Perhaps the combined body heat of closely grouped individuals and that of the sun helps them survive the cold. Manatees are really creatures of the tropics, and numbers have been killed by cold in Florida even as far south as Fort Myers. On cold mornings in the Everglades National Park we have several times encountered at least thirty-five, apparently banded together in small groups, in a mile of shallows along one meandering, mangrove-lined waterway.

The small population of sea cows in the St. Johns River in north Florida has a unique way of getting through the more severe cold in that part of the state. Upon the advent of a cold spell, the Manatees enter the warm water (70° to

72° F.) of a giant spring which flows into the St. Johns River. They remain in its crystal-clear waters during the cold snap or even for the entire cold part of the winter. This Manatee "hideout" is known as Blue Spring and is reached by a short road from Orange City. It is indeed unusual to find wild Florida Manatees in water so clear that you can see them serenely slumbering on the bottom ten feet below, for, as mentioned above, they usually inhabit waters which are turbid and dark. At Blue Springs it is common to see them rise periodically and dreamily to the surface to blow. Occasionally they bestir themselves to browse among the beds of wild celery on the bottom, although during cold spells they become rather torpid and seldom feed.

So — if a visitor to Florida wishes to enjoy a sight of this big tropical marine mammal — wild and free in its native haunts — these notes will provide him with several places to present his calling card.

SOMETHING NEW OUT OF AFRICA—

Double-tailed Earthworms

By G. E. GATES

FROM THE DUCKBILLED PLATYPUS of Australia to double-tailed earthworms from Africa seems a far cry, but the connection is there, and it came about by way of Florida and New York. The peculiar chain of events that eventually linked together these two animal curiosities — worlds apart both zoologically and geographically — started in 1946 with the decision of the Zoological Society to try to exhibit Duckbilled Platypuses. David Fleay, who developed a successful technique for keeping these rare and demanding creatures, found that one of their staple foods, in captivity at least, was earthworms. That was why a worm farm was started at the New York Zoological Park and it was through his operation of this farm that Curator Coates of the Aquarium brought to light the rare two-tailed worms.

In the Eighteenth Century Linnaeus, the first great classifier of animals and the inventor of the system of naming used by all scientists today, recognized only a single species of earthworm. But 300 years or more before his day, anglers knew there were several different kinds of angleworms

and could tell them apart. Today more than 2,000 species are listed.

If Curator Coates did not already know about the great variety of earthworms before he started to raise them for the Duckbilled Platypuses, the Platypuses themselves must have soon made him aware of it. To their finicky palates worms apparently have quite different tastes and some of the commoner types found around New York do not suit them very well.¹ In the search for more palatable worms, some strange kinds were turned up, and Curator Coates sent them to me for identification. Among these were at least two species never before found in the United States.

But the most amazing discovery came about through a contact that Mr. Coates established in

family of earthworms of which this species is a member is found naturally only in restricted portions of the African continent. We tried to find out how these worms got to Florida, but Mr. Baker did not know. A few cans of them had been inadvertently left behind in the icehouse at his fishing camp by a party of out-of-state fishermen. From these few hundred worms Mr. Baker had subsequently built up a great part of his stock of fishing worms. So we have no idea just where this African immigrant first became established in the United States or how long it has been here. Possibly the worms were carried from their original home in Africa in short stages and quite accidentally by man. One stage of the journey is certainly represented by the island of St. Helena,



1952 with Mr. Tracy W. Baker of Lake Geneva, Florida. Mr. Baker, who runs a large worm farm catering especially to anglers — there are many of these located throughout the United States — had seen a magazine article about the Park's establishment and had written to Mr. Coates for information and advice. Along with his letter he sent a small box of worms, including several with double tails, for identification.

Mr. Baker's worms turned out to belong to the species *Eudrilus eugeniae*, and their presence in Florida is about as surprising as would be a Bushman child on our front doorstep. For the whole

where the first specimens of *Eudrilus eugeniae* were secured. The worm was named after the Frigate *Eugenie* which made a round-the-world cruise in 1851-1853 in order to collect zoological specimens. At St. Helena, Dr. Kinberg, the ship's doctor, collected the first examples and later scientifically described them. For want of a better popular name we shall call them African Reds. This describes the color of the living worms and distinguishes the species from various American and European ones of a more or less similar color.

Three of the worms Mr. Baker sent to Curator Coates had the posterior part of their bodies duplicated. Their extra "tails" were well formed,

¹ ANIMAL KINGDOM, Vol. 54, No. 3, p. 95, 1951.

each containing a digestive canal and a nerve cord. One of the worms even showed the beginning of a third tail. Despite its diminutive size, this appendage, too, was equipped with a digestive tract. So far as is known, this specimen is unique; it is the only earthworm ever recorded as having three functional tails.

One of the most remarkable features of Mr. Baker's African Reds is the apparent frequency with which double-tailed individuals appear — perhaps in one out of every 500. This may not seem a high frequency, but two-tailed worms have never before to my knowledge been reported as occurring with any regularity. In all, about a dozen and a half abnormal specimens of the same type have been noted by biologists, but this was in six different countries, over a period of many years, and involved several different species.

All of these were more or less full grown, and double-tailed monsters of our present type have not been found inside the cocoons of earthworms. Biologists have therefore concluded that this abnormality is accidental rather than congenital. Two-tailed individuals have occasionally appeared in laboratory worms whose tails had been amputated. Instead of regenerating a single tail as they usually do, these individuals grew two. All of these, however, showed certain definite signs of the regenerative process, and such signs are entirely lacking in our double-tailed African Reds.

As far as the author knows, this is the only earthworm ever recorded with three functional tails. The double tail is quite small, but it possesses a digestive tract, as do the other tails in this specimen.

Moreover, Mr. Baker reports having seen small two-tailed worms which were apparently recently hatched. It looks as if the double-tailed African Reds were "born that way," but of course more study will be necessary to prove this.

There are other peculiarities about the African Reds that cry for solution. For instance, how do they grow?

People have wondered whether it is possible to estimate the age of an earthworm by counting its rings or segments, somewhat like the process of determining the age of trees or fishes by counting the growth rings of trunk or scale. Some biologists believe that when the little worm

hatches out of the cocoon it is provided with as many segments as it will ever have. In that case growth must take place only by increase in size of already existing segments. Others believe that earthworms may grow by producing new segments after hatching. It might be possible to settle the question by counting segments of a lot of juveniles as they hatch out of the cocoon, keeping them in favorable conditions for several months and then counting the segments again. This apparently has not been tried, even for one single worm. Two biologists attacked the problem of growth in earthworms by mathematical procedures. Cocoons were collected from a manure pile. As the young hatched out segments were counted until 250 counts had been made — and that could not have been easy on tiny and delicate individuals. Then 250 worms, of larger size but not sexually mature, were collected from the same pile and their segments counted. Finally, segments of 250 sexually mature adults, from the same heap, were counted. Mathematical manipulation of all that data proved that as the worms grew older the number of segments grew smaller! That surprised the biologists but it might have been expected if they had stopped to think about all the moles, birds, boys and other animals that bite or break off tails of earthworms. In certain circumstances, a worm even breaks off a portion of its own tail, a sort of self-amputation that is called autotomy. So, the longer a worm lives, the more likely it is to have lost a portion of its tail. Amputees can hardly be expected to provide information of much value about normal growth. After all that difficult arithmetic, the problem of the earthworm's method of growth was no nearer a solution than before, and as far as the African Reds with their two tails are concerned, the growth problem is in some ways twice as mysterious.

Scientists have been allowed little time and almost no money for the study of earthworms, and there seems little hope for improvement in that respect in the future. If anglers, earthworm farmers and gardeners, however, will keep their eyes open and take advantage of such opportunities as chance provides, they may be able to help us add to the sum total of our knowledge of these interesting and economically important creatures in the same way that Mr. Baker has done.

Our Red Deer herd, led by a magnificent buck now nearly 14 years old, poses for a group picture. This herd was founded in 1900, a few weeks after the opening of the Zoological Park, by the gift of a pair of Red Deer from William Rockefeller. He gave us two more pairs in 1902 and the herd has been self-perpetuating except for the acquisition of the present buck in 1941. There are 20 animals in this picture, the entire herd. Periodically it is necessary to dispose of the excess animals and at the moment, besides the buck, we have only does and the 1953 fawns.





SUNBIRDS

Are, Indeed, "Splendid Natural Ornaments"

By ROBERT M. McCLUNG

MOST OF US have experienced the pleasure of watching a Ruby-throated Hummingbird hovering over a blossom in the garden. Its metallic throat glittering fiery red, for a moment it is suspended as if by invisible strings; the next instant, swift as a shooting star, it disappears.

Less familiar to us are the Hummingbirds' Old World counterparts, the Sunbirds of Asia and

Africa. At the moment an excellent series of Sunbirds, as well as a few Hummingbirds, may be seen in the Jewel Room of our Large Bird House. Of all the world's birds, these two families, along with the Birds of Paradise, are probably the showiest and most beautiful, with their brilliant colors and unusual forms. Watching the faces of visitors and listening to their comments, the appeal of these birds to man's feeling for beauty cannot be denied.

Animals with bright colors — especially those with shimmering iridescent colors — have always excited man's admiration and fired his imagination. As a boy, I often stalked the big black Pipevine Swallowtails that fluttered around a neighbor's Dutchman's Pipe vine. I prized these butterflies especially because of their gleaming metallic colors. The forewings were a velvety blue-black, but the shimmering metallic hindwings changed from green to blue as they were viewed in different lights. I still remember boyhood hikes, when I would be rewarded by a brief glimpse of a Tiger Beetle sunning itself on a woodland path — a brilliant flash of green and gold in the sunlight. I seldom caught one of these prizes, for they were as fast and wary as they were beautiful.

Living creatures — especially birds and insects — which have iridescent or bright colors have often been collected and avidly exploited by man because of their beauty. Probably the most fa-

Apart from iridescence, some of the Sunbirds are otherwise rather gaudy — the Regal of the northeastern Belgian Congo has a red breast.





mous examples in this connection are the Birds of Paradise. The skins and plumes of these fabulous birds were yearly shipped by the thousands from the jungles of New Guinea to the fashion centers of Europe and America, until such trade was made illegal. However, the New Guinea natives still prize the skins and plumes of these birds, which they use for ceremonial adornment and head-dresses.

The great Morpho butterflies of South America are still taken and prized for their metallic blue wings, which are used by the natives to adorn themselves, and by civilized man in making costume jewelry and other articles of a decorative nature. Similarly, Hummingbirds are taken and valued in many areas of South America, as are Sunbirds in Africa and Asia.

Jardine, in "The Naturalist's Library," published in 1836, tells how the skins of one African species, the Red-breasted Sunbird, was exploited:

"This well known and elegant little bird seems to be particularly common in Senegal, from whence great numbers have been recently sent to Europe as articles of commerce. This unusual

The Tacazze, especially notable because of the red-purple area of its back and its shimmering bronze throat, is one of the larger Sunbirds.

importation has arisen from the demand for Hummingbirds, and others of small size and rich plumage, in consequence of the fashion so prevalent with the fair sex, of decorating their hair with these splendid natural ornaments."

Apart from the metallic colors which are so prevalent in both Hummingbirds and Sunbirds, there are many other striking points of similarity between the two families, although they are not closely related at all. Both groups of birds are remarkable for their generally small size, their long, slender bills and their predilection for flowers as an important source of food. Like Hummingbirds, cock Sunbirds are often adorned with brilliant tufts of feathers, usually on the breast. Some Sunbirds have two very long graduated tail feathers, extending far beyond the rest of the tail, somewhat like the trains of various Hummingbirds. The casual observer in a foreign country might be hard put to know whether he



The Bronze Sunbird in a typical feeding posture. It perches as it drinks. Note its stout legs and how the feet grasp tightly.

With tiny, weak feet and legs, a Hummingbird hovers in mid-air in order to feed. This little creature is Boucard's Train Bearer.



had seen a Hummingbird or a Sunbird, except for the fact that Hummingbirds are exclusively New World birds, while the Sunbirds are found only in the Old World.

Despite their similarities, the differences between Sunbirds and Hummingbirds are obvious to the ornithologist and indicate that there is no near kinship between them. Hummingbirds are not perching birds. Their tiny, weak feet mark them as belonging to the order Apodiformes, which means, literally, "without feet." Their

closest relatives are the Swifts. Hummingbirds have long, pointed wings which beat so rapidly — sixty or more times a second in some species — that they are practically invisible, this high speed enabling the Hummingbird to hover motionless in the air, to fly straight up or backward.

Sunbirds, on the other hand, have strong and well-developed feet, and belong to the great order of Passeriformes, or perching birds. Their nearest relatives are probably the Flower-peckers of Asia. The Sunbirds' wings are usually rounded. While

they are swift and accomplished fliers, the Sunbirds have never developed the ability to hover with quite the easy perfection of the Hummingbirds.

Newton, in his classic, "Dictionary of Birds," states that the Sunbirds got their names originally from natives of Asia, in tribute to their brilliant, shining plumage. Metallic hues of blue, green, violet, amethyst and bronze shimmer and glow in strong light, changing from one shade to another as the bird moves. Even more vivid are their non-metallic colors — reds and yellows.

Most non-metallic colors in feathers are caused by a chemical substance or pigment which absorbs some light rays and reflects others. In contrast to this type of "chemical coloration" are "structural colors." Sometimes the shade or color is due to the surface structure of the feather in conjunction with underlying pigments, but most metallic or iridescent colors are the result of structural features of the feather — very fine striations or ridges or thin films, which break up and reflect light rays much as do glass prisms.

In various parts of their range, Sunbirds are called by other descriptive but localized names. In parts of India they have been known, confusingly enough, as Hummingbirds. Captain G. E. Shelley states in his monograph of the Nectariniidae or Sunbirds,¹ that on Prince's Island off the west coast of Africa, the local species are called "Beshaflore," or "Flower-kissers," by the Portuguese. In Madagascar they are sometimes termed "Soumanga," or "Sugar-eaters." The *Arachnothera*, a genus of large, dull-colored Sunbirds native to Malaysia, are known as "Spider-hunters."

In his systematic revision of the group, Delacour recognized more than one hundred species of Sunbirds.² There are at least twice that many recognized subspecies. Sunbirds inhabit great areas of the Old World, from Madagascar through large portions of Africa, with one species being found in Palestine and Syria. To the eastward they are represented by numerous species in

India, southeast Asia and the many islands of the southwest Pacific, including, among others, Sumatra, Java, Borneo, the Philippines, Celebes and New Guinea. One form is found in the northeast coastal areas of Australia. Living mainly in the tropics, Sunbirds are to be found from sea level up to the snow line on some mountain slopes.

Some forms are widespread in their range while others are astonishingly restricted. The Ruwenzori Double-collared Sunbird is said to be found only in a belt about 1,200 feet in width, from 10,000 to 11,200 feet of altitude on the slopes of Mount Ruwenzori in Uganda, while the Scarlet-tufted Malachite Sunbird is known only from the cold and bleak alpine zone of Mounts Kilimanjaro and Kenya, at elevations from 10,000 to 14,000 feet.

Most Sunbirds are non-migratory, in the customary sense. However, many make regular local movements, always being found when and where their favorite food plants are blooming. Some species in mountain areas will be found at high



¹ "A Monograph of the Nectariniidae," 1880.

² "A Revision of the Family Nectariniidae (Sunbirds)," Delacour, 1944.

Another one of the more brilliant Sunbirds is the Ruanda Double-collared, with an iridescent head and shoulders and a red breast.

altitudes during the summer flowering season, while in the winters they descend to the lowlands.

As Nectariniidae, the scientific name of the family, would indicate, the principal diet of most Sunbirds is nectar, which they gather from flowers. The long, slender and somewhat curved bill is an admirable instrument for probing, and from it the tongue may be thrust deep into the cup of a blossom to suck the nectar or pick up tiny insects. The tongue is usually flat for its basal one-third, evolving into a single tube which often becomes two tubes lying side by side near the front. In some species the tip of the tongue is minutely divided, almost brushlike.

While nectar forms a large portion of the Sunbird diet, tiny insects and spiders are also eaten. Some Sunbirds pierce the base of long, tubular flowers with the beak, after which the flicking tongue picks up nectar or insects.

The flight of Sunbirds is swift and often undulating, with rapid wingbeats. Hovering less casually than Hummingbirds, they often cling to stems, branches or tree trunks like titmice or warblers, searching crannies for food. When probing a flower, they usually perch on the stem, or flit nervously from one stand to another, fluttering their wings or flicking their tails.

Just as Hummingbirds are often familiar sights in our gardens, so are Sunbirds often seen around the gardens in many areas of Africa, India and the East Indies. A charming account of the behavior of the Amethyst-rumped Sunbird, a familiar visitor in the flower gardens of Ceylon, was written a century ago by a Mr. Layard:³

"My house in Colombo, was, as is usual in the East, surrounded by a verandah, upon which crept, in tropical profusion, several species of Passiflora; to the flowers of these came the various Nectariniidae for their morning and evening meals, rarely appearing in the heat of the day; they would fly into the verandah and seize a small spider from its web, or from the crevices of the wall. Then they would betake themselves to the trellis supporting the passion-flowers, or to the branches of a pomegranate close by, where they preened themselves and uttered a pleasant song. If two happened to come to the same flower, (and, from their number, this often occurred), a battle always ensued, which ended in

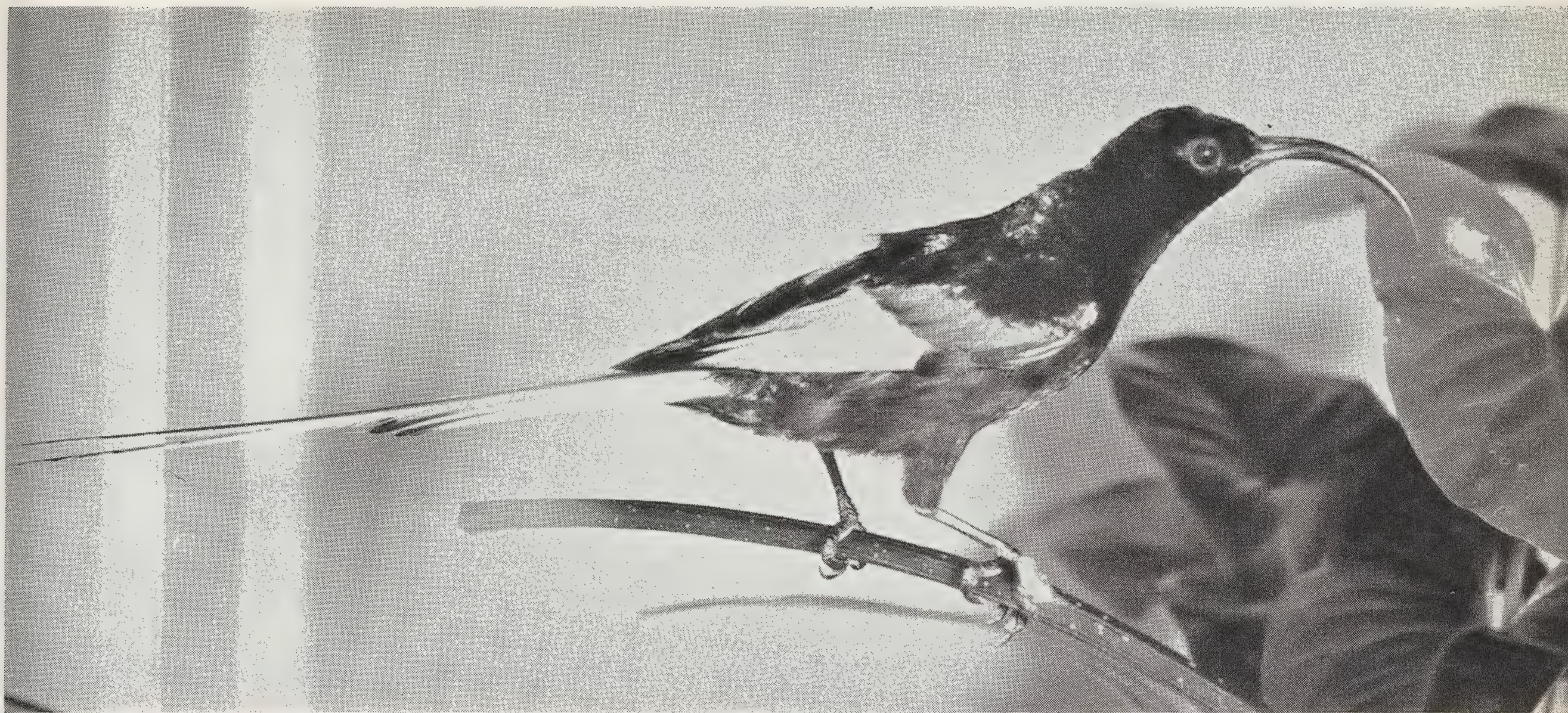
the vanquished bird retreating from the spot with shrill piping cries, while the conqueror would take up his position upon the flower or stem and, swinging his little body to and fro till his coat of burnished steel gleamed and glittered in the sun, pour out his notes of triumph. All this time the wings were expanded and closed alternately."

A less pleasing observation concerning this same species is related by Shelley, who states that natives would capture them by using bird lime, and after plucking out their flight feathers so that they could not flutter, would tie them to sticks in rows, and carry them about for sale in the market places.

Sunbirds, like Hummingbirds, can be very pugnacious. During the breeding season, males of various species have been observed fighting each other furiously. A male bird may lay claim to a certain territory which he defends vigorously against all rivals, chasing away intruders. In courtship, the male may display before the female with quivering wings. The tufts of feathers so conspicuous in certain species are erect and prominently displayed during the courtship ritual.



³ "Ann. Nat. Hist.," 1853. Second Series, XII, pp. 174.



Many Sunbirds have short but often quite pleasing songs. The notes are usually rather shrill and metallic, but the total effect may be musical. The commonest notes are short, sharp "twits."

The cock bird usually has all the bright plumage, while the females for the most part are an inconspicuous olive-green or gray. In a very few forms the female may have some metallic coloring, too. In some species the male bird molts after the breeding season and takes on a dull eclipse plumage, much like that of the female. Young male birds resemble the adult female until they assume their first breeding plumage.

The nests, usually oval or pear-shaped, are commonly suspended from the underside of a large leaf or tip of a branch. The opening is at one side, often with a small roof or protective portico over it. Materials used in nest building are plant down, mosses and fine grasses. In several species, at least, dead leaves or other odds and ends are attached below the nest, often trailing a foot or more below.

Sunbirds will live quite well in captivity. We usually keep them alone or in pairs in individual cages, although Bronze Sunbirds have in the past been kept successfully in communal cages with other birds. They are given the same general diet

Scarlet-tufted Malachite Sunbird is one of the more striking species, found at elevations of 10,000 feet in the highlands of Africa.

The Golden-winged Sunbird from the highlands of Kenya and Uganda has an iridescent throat best described as gold-washed purple.

as Hummingbirds receive — a mixture made up of honey, condensed milk and Mellin's food mixed with water, to which several drops of vitamin concentrate are added. In addition fruit is given. In the afternoon, a fresh mixture of water and honey is given to the birds. If small insects such as fruit flies can be supplied, all the better.

The first Sunbirds ever shown in the New York Zoological Park were a group of Indian Purple Sunbirds, purchased in Europe by Mr. Crandall in 1912. Through the years, individuals or several birds at a time were received, but our first considerable acquisition was a collection of 17 specimens captured by Charles Cordier in the Belgian Congo and received in June of 1949. Some of these birds are still living in our collections. Since 1912 we have exhibited 18 different forms, only two of which were Asiatic.

At the present time we have seven forms of Sunbirds, thanks in large part to the collector, Mr. John Seago, from whom we purchased nine specimens of five beautiful Kenya species early this year. When one looks at the brilliant coloring of the Double-collared Sunbird or the Malachite Sunbird, or the dazzling yellow and black of the Golden-winged Sunbird, it is easy to see why we call their exhibit hall the "Jewel Room."

Final Report on the Society's Own "Point Four" Program

By ROSS F. NIGRELLI

Chairman of "Point Four" Program

THE END OF 1953 also brought the formal ending of the "Point Four" Program initiated by the Zoological Society two years ago to aid European biologists in their scientific research. It is a "formal" ending only technically, because the actual results of this program should have no end — at the very least, the equipment furnished through it will go on being useful for years to come, and the feeling of good will engendered by it can never be measured in dollars and cents.

This feeling of appreciation and more-than-professional identity has not been one-sided, for the members of the Zoological Society's Committee appointed to distribute the "Point Four" funds, came to regard the work done by our European colleagues more highly than ever before and to consider it a privilege to be able to help them.

It was the job of the five of us — Miss Jocelyn Crane and Dr. William Beebe of the Department of Tropical Research, Director John Tee-Van, Curator of Reptiles James A. Oliver and myself — to weigh the applications for funds, deciding who should receive them and exactly how much. Naturally this was not an easy task, but it was a most satisfying one because of the opportunity it gave the Society to recognize and extend a helping hand to research projects of undoubted value.

As in 1952, the Society's Board of Trustees set aside \$5,000 for use in 1953. Also as before, no single grant exceeded \$400. In all, workers in twenty different institutions in nine European countries received aid. In cases where the cost of the required equipment exceeded the amount

we felt we could allot, we did not hesitate to give a sum partially covering the expense, for with part of the necessary money actually in hand, the recipient was frequently able to obtain the rest from other sources.

The range of projects assisted was as various as it had been during the first year of operation, as may be seen by the following résumé of requests filled during 1953.

England

Bower Birds for comparative studies on their bower-building, courtship and other behavior.

Travelling expenses and trapping apparatus to observe insect migration in the Pyrenees.

Books and optical equipment for analyses of the vision of lower animals.

Snakes and lizards for determining the function of the fat bodies found in reptiles.

Microscope and a set of books necessary for research on the classification of beetles.

Nucleus of American books for a library specializing in field studies of birds.

Ireland

Low-power microscope to be used in an attempt to grow tapeworms in the laboratory outside of their hosts.

France

Paper needed for publishing one volume of a bibliography of spiders and their relatives.

Motion picture camera to photograph the behavior of mammals, birds and protozoans.

Assistance in the construction of special electro-chemical apparatus for studying substances essential to living tissues.

Belgium

Electrical meter to determine the acidity or alkalinity of aquatic habitats.

Germany

Sound filter necessary to analyze the noises produced by animals and the sounds to which they react.

Photographic material for studies on the behavior of insects.

Photographic supplies to be used in comparative behavior studies of various rodents.

Austria

Motion picture camera to record the activities of growing animals.

Netherlands

Books on birds of North and Central America and the West Indies to aid in studies on their taxonomy and geographical distribution.

Italy

Equipment, mostly glassware, for laboratory work on sea-squirts.

Microtome to section adrenal gland tissue for study under the microscope.

Chemicals essential to a study of the vital materials in the nucleus of the living cell.

Spain

Books and photographic equipment to aid in the study of Spanish shellfish such as crabs and spiny lobsters.

Publications in bio-mathematics needed for analyses of the process of sex determination, species formation, etc.

* * *

Obviously a program such as the Society's biological "Point Four" could go on forever, or at least as long as there are scientists working on problems of research. The past year has seen an improvement in European private and public funds available for research, however, and it was felt that the need for the kind of assistance we have been giving has appreciably lessened.

It's the "Fearsome Warracaba Tiger"

By WILLIAM BRIDGES

ONE MAN'S IMPLICIT BELIEFS are likely to be another man's superstitions, and this is never truer than in matters of popular beliefs about animals. The white races are particularly prone to smile at the credulities of "native peoples" in less materially advanced parts of the world — forgetting our own heritage of superstitions about black cats, "Ground Hog Day," Woolly Bear caterpillars, "hoop snakes" and the like.

Smile we must, though, at the redoubtable "Warracaba Tiger" of British Guiana, for at the moment we have one in the Zoological Park and at this distance from the forests of the Guianas it is hard to reconcile this peaceable wild dog

with its legend. The Warracaba Tiger, as we know it, is simply *Icticyon venaticus*, otherwise called the Bush Dog. Our young male is certainly not tame, but it is by no means intractably fierce and it has no hesitation about trotting over to the front of its compartment when it is called or stopping to sniff a hand held out to it.

It may be that even in its native country the dread of the Warracaba Tiger is dying out. Nicholas Guppy, nephew of the Guiana naturalist, P. L. Guppy, and himself a botanist who has recently spent considerable time in British Guiana, reports an impression that while the older Indians believe that Warracaba Tiger packs still exist in remote mountain districts, the



younger men — with, perhaps, more contact with white people and less familiarity with the wild areas — are willing to accept the white man's identification of the "Tiger" with the Bush Dog.

More than forty years ago when Lee S. Crandall, now General Curator Emeritus, was working in British Guiana, he heard many stories of the Warracaba Tiger, although he met no Indian who professed to have seen the animal.

"The way it usually happened," he recalls, "an Indian would be in his hammock some night and he'd hear a pack of Bush Dogs in the distance. They may yelp or bark as they run — I don't know; I never saw a pack. At any rate, as far as the Indian was concerned, it was a pack of Warracaba Tigers and he wasn't going to investigate any further. Even in daylight he had a tendency to get away fast if he heard those same sounds. That could be why you never found an Indian who had actually seen Warracaba Tigers.

Our "Warracaba Tiger," better known as a Bush Dog, is not exactly tame but it is interested in visitors and sometimes wags its tail.

"They all knew the Bush Dog, for you run across one occasionally. They simply didn't connect it with the sounds they heard in the night. At least that's a good working theory."

White men, on the other hand, being more skeptical by nature and never having encountered any animal except the Bush Dog that fitted the Indian description of the Warracaba Tiger, settled it in their own minds that the tiger and the dog are one and the same. That is the general belief of naturalists today.

Many of the older books about life in British Guiana recount stories of the Warracaba Tiger. Henry Kirke's "Twenty-five Years in British Guiana," published in 1898, has one of the fullest accounts, since it incorporates a quotation from

an earlier author. Here is what Kirke says about the animal:

There is a mysterious beast in the forest called by the native Indians the "waracabra tiger." All travellers in the forests of Guiana speak of this dreaded animal, but strange to say, none of them appear to have seen it. The Indians profess the greatest terror of it. It is said to hunt in packs (which tigers never do), and when its howls awake the echoes of the forest, the Indians at once take to their canoes and wood skins as the only safe refuge from its ravages. Mr. C. Barrington Brown, in his book, "Canoe and Camp Life in British Guiana," says that one day, when he was on the Curiebrong River, a branch of the Massaruni, he had a curious encounter with these animals. To quote his words: "I was busy writing letters when my attention was attracted by our two dogs, which had been tied up, barking furiously, followed by a great stir in the camp. Then some voices proclaimed loudly, 'The tigers are coming!' and one man called to me to come down as quickly as possible to the boats and bring my gun.

"Thinking at the moment that a couple of jaguars had been heard close by, I seized my gun and made a rush down the slope, eager to get a shot at one, when, to my surprise, I found the beach deserted. Where some twenty Indians had been camped, there was now not even a hammock left; all had suddenly and completely vanished, leaving only a stray hammock-pole and the smouldering fires. My men had all taken to the boat, and had it afloat, with the bow barely grounded, in readiness to shove off. They greeted me with cries of, 'Quick, quick! the waracabra tigers are coming!' There was quite a flutter of relief amongst them when the boat was pushed off into mid-stream, when they all began to talk excitedly over our escape. The dogs still gave tongue, and were even more excited than the men, the hair on their backs standing erect as they sniffed the air in the direction of the camp. I eagerly inquired what were waracabra tigers, and was hastily informed they were small but exceedingly ferocious tigers; that they hunted in packs,

and were not frightened by camp fires or anything except the barking of dogs. We crossed the river, and as we stopped a shrill scream rent the air from the opposite side of the river, not two hundred yards above our camp, and waking up echoes in the forest, died away as suddenly as it rose. This was answered by another cry, coming from the depths of the forest, the intervals being filled up by low growls and trumpeting sounds, which smote most disagreeably on the ear. Gradually the cries became fainter and fainter, as the band retired from our vicinity, till they utterly died away. Seeing nothing of them, and hearing their diabolical screams, I pictured them in my mind as a withering scourge sweeping through the forest. The call of these animals resembles that of the waracabra or trumpet bird (*Psophia crepitans*), hence they have obtained the name of waracabra tigers. The Accawoio Indians call them y'agamisheri, and say that they vary in size as well as in colour. As many as a hundred have been seen in a pack."

These strange animals cannot be felidae, as they are never known to hunt in packs. Their screams recall recollections of the packs of jackals in India; so I suspect they must be animals of the jackal or wolf tribe, especially as they are said to live in the mountains, and only come to the low land in the dry season, and when pressed by hunger.

Brown's account, quoted by Kirke above, is cited in Everard F. im Thurn's "Among the Indians of Guiana," published in 1883. Thurn adds a few embellishments to general knowledge, however; he had heard the name "Warracaba Tiger" (or Waracabra) attributed to the resemblance between the cry of the "tiger" and the call of the Warracaba Bird, and also to the resemblance of the color of the mammal to the breast feathers of the bird. Again, he had been told that the name comes from the fact that the "tigers" prey on the bird. Thurn professed to have found three persons who had actually seen Warracaba Tigers, but he admitted that one of his informants, a Portuguese policeman who had been chased up a tree by a "flock" of the animals, went on to build his story up in an obviously exaggerated form.

Thurn's own suggestion was that "possibly all the stories may be founded on the fact that families of pumas (*F. concolor*), consisting of parents and cubs, occasionally move about together."

Despite the reports of various writers that the Warracaba Tiger is so named because of the resemblance of its cry to that of the Warracaba Bird, or Trumpeter, it takes a good deal of imagination to connect the two. The "Tiger" is supposed to make a loud and fearsome sound, a "diabolical scream," whereas the call of the Trumpeter — at least those specimens that we have exhibited — is low and not at all intimidating. It can be roughly put into words as a descending series of booms followed by a rumbling roll. The only sound we have heard our Bush Dog make is a kind of whistling whine.

There are many references to the "tiger" in the literature about British Guiana, but one final quotation would seem to settle the matter. It is from the Thirteenth Annual Report of the Bureau of American Ethnology of the Smithsonian Institution, 1908-1909, and specifically from an article, "An Inquiry Into the Animism and Folklore of the Guiana Indians," by Dr. Walter E. Roth, formerly Commissioner of the Pomeroon District of British Guiana.

"I am afraid," he wrote, "that the existence of a Warracaba tiger, like many another quaint conceit, must be consigned to the oblivion of superstition."

* * *

Our "Warracaba Tiger" was captured in the interior of British Guiana by Charles Cordier on his 1953 collecting trip to the Guianas. Crossing a river one day in a small outboard motor boat, he encountered three of the dogs swimming. They were netted and hauled into the boat, but only after one was injured by being struck by the propeller. At the Cordiers' base camp, Mrs. Cordier confined them in what she considered an extremely heavy and safe cage, made of thick boards and wire netting. Nevertheless the male managed to chew his way out and to escape. He was recaptured after he returned to the vicinity of the female, which had not escaped. Later Mr. Cordier caught still another specimen.

We have exhibited *Icticyon venaticus* only once before, in 1931, but some ten years before that time the species had been exhibited in Amsterdam Zoo, and had bred there. It is still a rare animal in zoological collections, and much remains to be learned about its life in the wild.

News from the Conservation Foundation

Mid-Century Conference Held

President Eisenhower addressed the opening meeting of the Mid-century Conference on Resources for the Future, held in Washington in December. Various officers of the Conservation Foundation took active parts in the planning of this conference: Mr. Osborn as a member of the Planning Committee, Mr. Ordway as Counsel, Mr. Snider as Assistant to the Chairman for the Panel on Research and Mr. Bergen as rapporteur for the Panel on Water Supply. Enrollment of businessmen, educators, technicians and civic leaders was 50% greater than anticipated, and totaled 1,460 individuals. While the proceedings indicated that there was difference of opinion as

to whether the increasing demands of our population and economic growth in the next 25 years can be met by new technological discoveries and the development of substitutes, there was general agreement that conservation and the use of our natural resources is one of the most crucial problems that faces our nation.

Natural Resources Council

Samuel H. Ordway, Vice-president of the Foundation, has recently been elected Chairman of the Natural Resources Council of America, a group of representatives of more than thirty conservation organizations which serves as a clearing house of information and policy guidance. The Council does not take political action.

Statistical Data on Jamaica Population

George W. P. Roberts, one of the leading demographic statisticians of the British West Indies, on leave from the British West Indies Development and Welfare Organization in Barbados, is now engaged at the office of the Conservation Foundation in completing statistical studies which are part of the Foundation's research project on the relationship of population trends and resources on the island of Jamaica. This project should be completed during 1954.

New Books by Staff Officers

Mr. Osborn's new book, "The Limits of the Earth," is now selling ahead of sales made during the comparable period by his previous book, "Our Plundered Planet."

"Resources and The American Dream," by Samuel H. Ordway, was published on October 23. It challenges several existing concepts regarding American materialism, and has been the subject of a series of radio discussions.

Boy Scouts in Conservation

During the past two years officers of the Conservation Foundation have held many conferences with officers of the Boy Scouts of America to help develop a major conservation program for the five million men and boys engaged in Scouting.

This year, on the recommendation and at the request of President Eisenhower, the Boy Scouts have launched a major program entitled "The Conservation Good Turn" which will lead all levels of the Scout organization and individual Scouts into intensive study of local conservation problems and local action to publicize the problem and improve the use of resources in every community. Fairfield Osborn is a member of the Scouts National Conservation Advisory Committee and of the Committee on Activities and Special Events for 1954.

Recent and Forthcoming Books

These three books, sponsored by the Conservation Foundation, have either just appeared or will soon be published:

"Wildlife in Alaska — An Ecological Reconnaissance," by A. Starker Leopold and F. Fraser Darling.

"The Flood Control Controversy — Big Dams, Little Dams, Land Management." An analysis of upstream and downstream programs, by Luna B. Leopold and Thomas Maddock, Jr.

"Fresh Water from the Ocean — for Cities and Farms." A technical study of the feasibility of converting salt-water to fresh on a large scale, by C. E. Ellis.

BEHIND THE SCENES

**NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH**

Praise for Beebe-Crane Film

Several years ago Dr. William Beebe and Miss Jocelyn Crane, while working at the Department of Tropical Research laboratory in Venezuela, put together a 16 mm. motion picture, in color, called "Curioseando en las Selvas Venezolanas." Recently Dr. Beebe has been informed by Sr. Guillermo Zuloaga, vice-president of the Creole Petroleum Corporation, that the picture has been seen by approximately half a million persons and that it is still in demand in Venezuela. The Venezuelan Foreign Office has distributed the

picture through its embassies. "The Beebe and Crane film has easily been the most successful movie venture that we have ever undertaken," Sr. Zuloaga wrote Dr. Beebe. — W. BRIDGES

"People and Animals"

An informative and thought-provoking article by President Osborn appeared in the January issue of *The Atlantic Monthly*. Entitled "People and Animals," it recounts anecdotally some of the things we have been learning about animals as a result of years of zoo-keeping, and cites inci-



A 13-foot Anaconda in our reptile collection enjoys special privileges. At cage-cleaning time each day, Keeper Spencook gives it a few minutes' liberty in the corridor behind the cages. The snake is now so accustomed to its outing that on occasions when the keeper does not allow it to go outside, he has a good deal of trouble keeping it in the cage.

dents of the interactions between the staff and the animals, between visitors and the animals. "A zoo is the best kind of antidote to the over-mechanization of these modern days," Mr. Osborn concludes. "To many people it is more than that. To them the observation and study of animal life in its myriad forms is a lasting inspirational experience — a revelation of movement, color, and sound, the end results of timeless processes of adaptation and evolution." — W. BRIDGES

Duck-bills Are on Exhibition

Our Duck-billed Platypuses, Cecil and Penelope, were placed on exhibition on Saturday, January 9, in their new Platypusary in the Heads & Horns Museum. The animals will alternate exhibition days, from 2 to 3 o'clock each afternoon. Admission is 10 cents plus tax, but Members of the Zoological Society will be admitted without charge. — W. BRIDGES

"Unseen Life in New York"

Less in the nature of a book review than of a report to our Members, this is an announcement of the publication of Dr. William Beebe's latest

book, "Unseen Life in New York." Parts of the book appeared a few years ago in *ANIMAL KINGDOM* when Dr. Beebe was writing about "The Broadway Mastodon," "The Sabre-toothed Tiger," "The Manhattan Grubber," and other now extinct creatures that once roamed the precincts of the Bronx Zoo.

In his new book the Director Emeritus of our Department of Tropical Research has assembled a series of essays, or articles, on the animal life of the New York City area in prehistoric times, as recorded in fossils; of vanished life of later days that is now remembered in books; and then the still-existing and surprisingly varied life of the present time that can only be seen by means of a microscope, or patient investigation — or by the imagination of a William Beebe.

The apt and amusing illustrations of the book are by Donald T. Carlisle. It was published by Duell, Sloan & Pearce — Little, Brown, and the price is \$4.00. — W. BRIDGES

Zoological Park Miscellany

In the Aquatic Bird House is a new Frigate Bird from Florida, the first specimen we have

exhibited since 1946. Unable to take off in flight from a level surface, it perches most of the time on a low stone in the Flight Cage . . . A three-year-old female Wolverine and a year-old male have been received from Denmark and will be introduced to our current exhibit of two females . . . Black-tailed Marmoset twins were born in the Animal Nursery early in January . . . A baby Gray Phalanger emerged from the maternal pouch on January 4 and at the end of the month was still spending a good deal of time in the pouch, although its body had grown to a length of about six inches and its tail to the same length . . . The reptile collection, scattered in basements all over the Zoological Park since remodelling of the interior began last summer, is gradually returning to the Reptile House as reconstruction nears its end. The building will not be ready for visitors before the spring, however. There will be a special re-opening for members of the Zoological Society.—W. BRIDGES

PUBLICATIONS OF INTEREST

REPTILES AND AMPHIBIANS — A Guide to Familiar American Species. By Herbert S. Zim and Hobart M. Smith. 157 pp., distribution maps and numerous colored illustrations by James Gordon Irving. A Golden Nature Guide, Simon & Shuster, New York. \$1.50.

The authors and the artist of this little book have produced an attractive introduction to the common amphibians and reptiles of the United States. It provides an abbreviated general summary of information on the characters and nature of these animals, followed by short accounts of individual species or groups of species. The latter are illustrated in color and their distribution in the United States is outlined on an inset map.

This guide will doubtless serve as the starting point for many budding herpetologists and amateur naturalists interested in learning about amphibians and reptiles. For this purpose the book is admirably conceived and well organized, but unhappily its execution is sometimes faulty. It would be but carping to base this statement on minor flaws in typography. However, there are several seriously misleading statements in the book and Mr. Irving's illustrations occasionally vary far from actuality. As was pointed out in the March-April 1953 issue of *Animal Kingdom* in a review of Zim's book, "Alligators and Crocodiles," it is incorrect to say that the body temperature of reptiles "remains about that of the surrounding air." It is ecologically naive and scientifically inaccurate to state that amphibians and reptiles "should be protected for our own enjoyment and for the future. . . . If they should all disappear, it would not make much difference one way or the other." On page 12 the statement is made that "Neither reptiles nor amphibians are intelligent enough to make good pets. . . , " but on page 17 appears the

Another Longevity Record

When Karl Plath, now Curator of Birds at the Chicago Zoological Park, was a private aviculturist, he received three Black-necked Stilts, *Himantopus h. mexicanus*, from Utah. These birds had been hatched in the spring of 1934 and carefully hand-reared. They were received by Mr. Plath on August 19, 1934. After enjoying the "Three Graces" for some weeks, he reduced the triumvirate to two by graciously sending one to us in exchange. The bird arrived here on October 30, 1934. Stilts, like Avocets, are among the most delicate of shore-birds and we did not expect too much of our beauty. However, as the years rolled on, our opinion of the viability of stilts changed with them. When this lovely and exceptional individual died on December 14, 1953, she had established a record with us of 19 years, one month and fourteen days, a remarkable span for the species and far in excess of any other that is known to us.—L.S.C.

remark that "Some reptiles make interesting and unusual pets." To further contradict this first statement the authors state in the separate species accounts at least eight times that particular forms make "fine," "good" or "excellent" pets. Despite these and a few other slips, "Reptiles and Amphibians" will prove a useful little guide to our more familiar species.

—J. A. OLIVER

WILDLIFE IN ALASKA. An Ecological Reconnaissance. By A. Starker Leopold and F. Fraser Darling. 129 pp., 6 text-figs., 22 photographs. The Ronald Press Co., New York, 1953. \$2.75.

The ecological reconnaissance of Alaska treated in this new book was sponsored by the New York Zoological Society and the Conservation Foundation. President Fairfield Osborn's "Foreword" will serve as a pertinent announcement:

"This field study concerns the great horned animals of Alaska and their environment in one of the last frontier lands of the world. A work of keen observation and scholarship, it analyzes the ever changing relationships between man, these grazing animals, and their habitat. It stresses the importance of wild life management in a territory whose invaluable assets are the living natural resources on the land and in the adjacent waters.

"With the development of Alaska's economy in mind, the authors recommend a broader and a more coordinated approach to the management of these resources. The adoption of such recommendations is particularly important in a region where the resources of the land, despite some early despoliation, are still largely intact and remain, with a few exceptions, the property of all the people of the United States. The situation presents a unique opportunity to initiate a comprehensive conservation program before the territory is subjected to haphazard development."

SIAMESE CAT BOOK. By Vera M. Nelson. Illus. by 27 photographs in black and white and 5 line drawings. Pages 103 + viii. All-Pets Books, Inc., Fond du Lac, Wisconsin, 1953. Price \$2.

Both the owner of a pet and the more ambitious breeder and exhibitor of Siamese will find Mrs. Nelson's book useful and instructive. Sensibly and soundly written, it will serve to replace much prevalent nonsense concerning this attractive breed with realistic information. Pregnancy, birth of kittens, rearing and grooming for the final championship, are expertly treated in helpful detail and the curious, un-cat-like behavior of the Siamese cat has not been neglected. — L.S.C.

CARE AND BREEDING OF BUDGIES. By Cyril H. Rogers. Forty illus. in black and white, from drawings and photographs. 93 pages. Dover Publications, Inc., New York, 1953. Cloth \$1.75; paper, \$.65.

Since the recent relaxation of prohibitive regulations in many areas of this country, the attractive little Budge-rigar or Shell Parrakeet has achieved immense popularity as a house pet. It is now bred in captivity in large numbers and the young bird, taken from the nest and finished off by hand, is not only charmingly tame but may learn to repeat words and phrases in a tiny,

elfin voice. Mr. Rogers' book gives excellent advice on selecting, correct handling and feeding, teaching to talk and breeding. Under the latter heading, the complicated color patterns and their genetic relationships are fully explained. The drawings of Lloyd Sandford, Staff Artist of the Zoological Park, add much to the general attractiveness of a book which information centers and pet owners alike will find most useful. — L.S.C.

SONGBIRDS IN YOUR GARDEN. By John K. Terres. Introduction by Edwin Way Teale. Pp. 274 + xiv. Frontispiece in color, numerous line drawings. Thomas Y. Crowell Co., New York, 1953. \$3.95.

As Managing Editor of the *Audubon Magazine*, Mr. Terres is in an excellent position for keeping abreast of the latest developments in methods of attracting birds. In a field in which there is no paucity of literature, this newest volume will immediately find a place, for changing conditions must always be met with modern methods. Feeding, nest boxes, planting and other related subjects are covered thoroughly and in satisfactory detail.—L.S.C.

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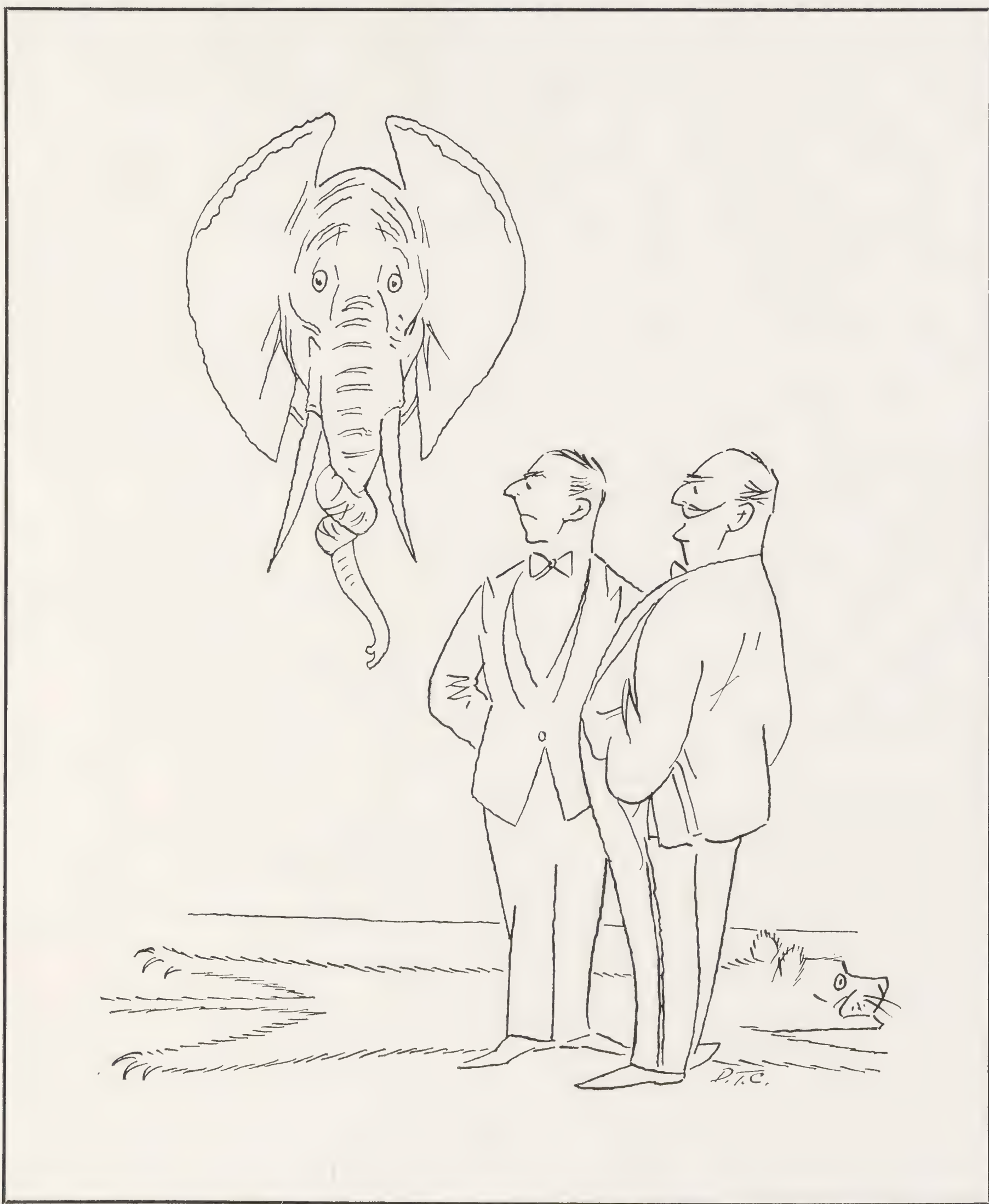
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"That? Oh, that's just to remind me to send in some names of people who ought to belong to the New York Zoological Society."

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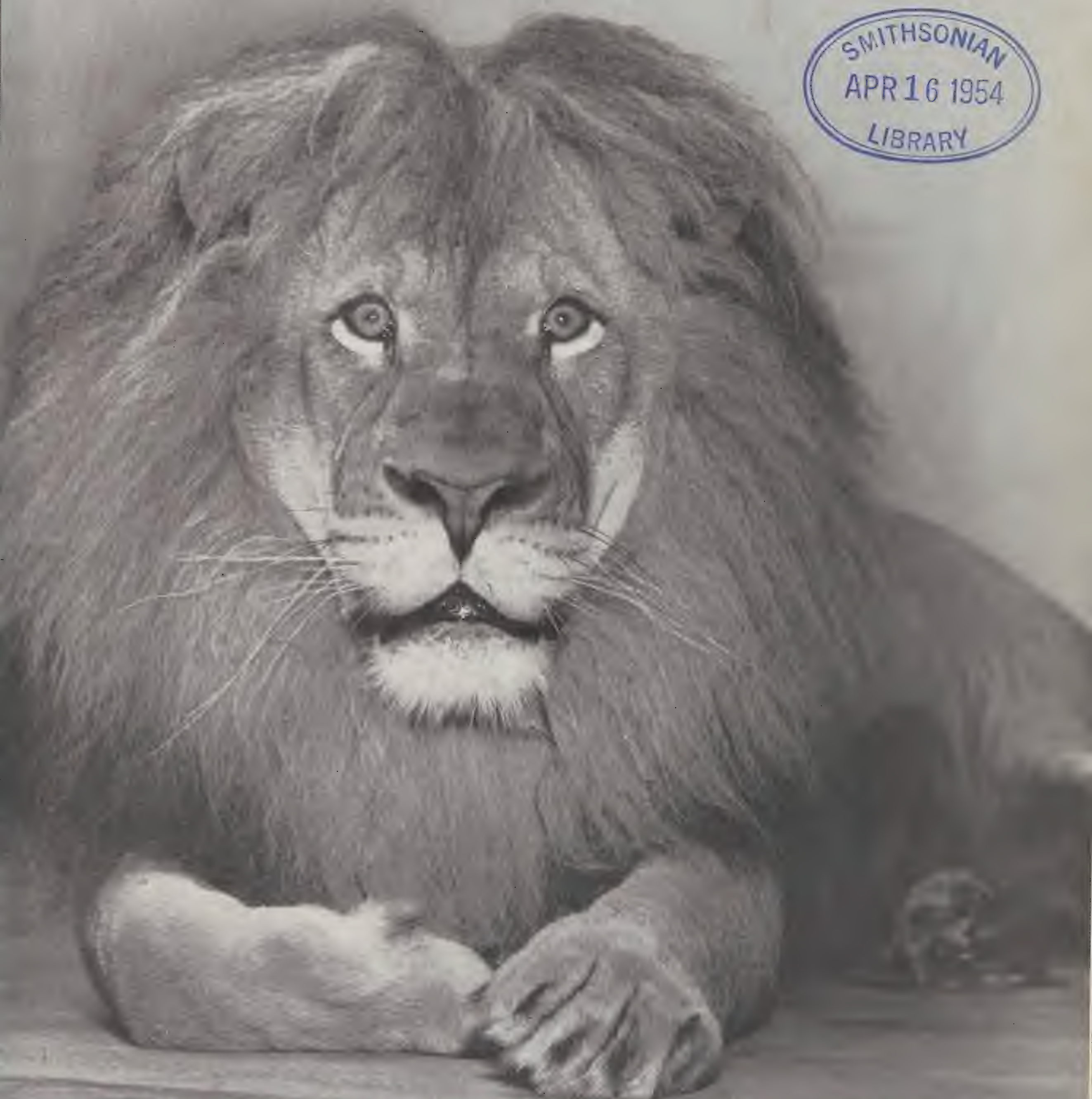
LVII • No. 2

MARCH - APRIL, 1954

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The National Parks—

Threatened Heritages

THERE ISN'T MUCH TIME LEFT before we Americans must come to a final and irrevocable decision, namely, do we wish to preserve our National Parks or do we not? There are those who say no decision is necessary, claiming that the National Parks are safe enough while at the same time endorsing programs which gradually, step by step and year by year, would whittle them down until one day, a generation or two from now, nothing but the shells of these irreplaceable regions would remain. Last year the Olympic National Park was under attack; this year the Dinosaur National Monument is under attack; next year still another will be the target of those who are blind to the eventual outcome—the gradual dissolution of our nation's few remaining natural heritages.

Unfortunately, the arguments for breaking into the sanctity of the National Parks are always persuasive, practical and soundly reasoned—on the surface at least. Water is needed from this one, timber from that one, minerals from another. From a purely material point of view the arguments for incursions into the National Parks are difficult to deny. The fallacy in these arguments is that the National Parks were established as recreational and indeed spiritual assets for our people. It happens also that they serve as the last remaining sanctuaries for some species of wildlife which otherwise would disappear forever.

The National Parks cannot be used to meet material needs and at the same time continue to provide our people with the intangible and yet more lasting and potent values for which they were created. It has come to a point now when compromise will ultimately prove fatal. The simple truth is we have accepted from those who went before us the pledge of trusteeship of these heritages not in the interests of ourselves alone but for all of our people through the long years that lie ahead.

Fairfield Osborn

The Biologist's Point of View

By ROBERT M. YERKES

THE GOLD MEDAL of the New York Zoological Society was presented, at the Members' Meetings on the nights of January 26 and 27, to Dr. Robert M. Yerkes of Yale University, whom President Osborn described as "a true pioneer in comparative psychology and animal behavior, whose lifetime work in this field has justified his title of the Dean of Comparative Psychology." Dr. Yerkes' remarks in acceptance of the medal — delivered by his daughter, Miss Roberta W. Yerkes — are such a wise and temperate statement of the biological scientist's point of view, that we have had many requests to publish them. Dr. Yerkes' address follows.

THIS RECOGNITION by your Society of what I have done as scientist is an extra dividend for labors whose rewards already have far exceeded my expectations and hopes. Sixty years devoted to the study of the behavior of man and other creatures have failed to provide me with a pattern of response fitting this situation. I am both elated and humbled. I highly respect the New York Zoological Society, which in many ways has facilitated my studies, and I am deeply grateful for the honor its Trustees have done me in designating me as medalist.

For me the Society is represented by notable services of *education*, of *research*, and of *conservation*. The famous Zoological Park provides for richly entertaining, educative experiences, and also for more serious naturalistic studies of our animal world; varied biological research is promoted and conducted, near and far, in field and special observational stations, as well as in the Zoo, and conservation is convincingly presented as necessary for improving and preserving conditions favorable to man's welfare. As an aside,

relative to conservation, I remark that both man and his cousins the great apes are extremely wasteful and destructive of their natural resources. This peculiarity may cause the genus *Homo* to disappear from the earth unless it is either correctively modified or compensated for by the control of population increase.

Today our world, which I consider well worth improving, urgently needs more such organizations as this Society to create and support services of enlightenment which make for open-mindedness, cooperativeness, and, above all, honesty with oneself and one's fellows.

The injunction "know then thyself" is generally accepted as wise, but few discover how. Surely it is not by isolating man from the world of which he is a part, or by concentrating attention on him as if he were an independent object. Instead, research to be most fruitful must be comprehensive as well as intensive and thoroughly objective. Often for answers to questions about ourselves we must turn to other organisms which are simpler, more readily available, or otherwise better suited to controlled observation and experimental use. Every creature has special values for the scientist, even though his primary interest is in human problems. In decades during which I have used chimpanzees and other primates as my principal objects of study and experimental subjects, experience has taught me that they have many values which are supplemental to those of human subjects, and from them I have learned much about behavior, its principles and products, that I probably should not have learned from man. Naturally I have come to think of our laboratory-bred chimpanzees as informational gold mines for the comparative psycho-biologist and many other specialists.

But as I now consider the lessons of experience

ROBERT M. YERKES
*though relatively few
may be scientists occu-
ationally, everyone can and
should be scientific in spirit
and understanding."*

(Photo by Dellenback)



I am still more impressed by the significance of some general conclusions to which I have been led than by facts, principles, or values discovered to or by me. In concluding these remarks I should like to present examples.

I am convinced: That individual success depends primarily on self-knowledge and its intelligent application in daily life;

That all natural values, not merely those of behavior, may be studied scientifically, described with increasing accuracy, and within limits modified and controlled;

That even though relatively few of us may be scientists occupationally, everyone can and should be scientific in spirit and understanding;

That the complete or well-rounded and satisfactorily educated person must be scientifically, humanistically, and artistically minded, whatever his vocation or means of livelihood;

That among the so-called "learned professions" and the hundreds of callings not thus classified, the one which is potentially the most important and the most deserving and demanding of our respect and support, is education.

And now I end as I began by pointing to the extraordinary importance, in the improvement and survival of *Homo sapiens*, of *education*, *research*, and *conservation*, each of which is a major activity of the New York Zoological Society.

SEABIRD CITIES

By BEN EAST • *Field Editor, Outdoor Life*

THE FIRST SEAFOWL CITY I ever saw was a nesting colony of Common Terns on a small island in Saginaw Bay, the wide arm of Lake Huron that separates the thumb of Michigan's lower peninsula from the rest of the mitten.

Lone Tree Island is a low, sandy crescent rising out of shoal water two or three miles offshore

at Sebewaing, surrounded in summer by dense green beds of rushes. It is unpeopled, and save for duck hunters who shoot there in autumn human beings rarely set foot on it, since there is little to lure visitors ashore or compensate them for wading or poling through the rush-grown shallows. All summer long Lone Tree is a place by itself, a wild and lonely place, set apart in its green jungles, where the only sounds are the whisper of the bay winds, the liquid songs of Marsh Wrens and Redwing Blackbirds, and the endless mewling of the terns.

We waded ashore that July day from a small skiff. The island rose no more than four or five feet above the water, a curving hogsback a quarter mile long, grown up with willows and scrub aspen at its wider end. There was a tangled growth of grass and weeds along the ridge for its entire length, and between that belt of vegetation and the rush beds that crept in to the water's edge lay a rim of sandy beach, open save for sparse clumps of weeds and bushes.

It is on that open beach that the terns nest, sheltered from the sea by the shoal water and the rushes. They have never been counted but in a good summer, when the water level of Saginaw Bay, in common with the rest of the Great Lakes, is low and a wide strip of beach is uncovered, there are not fewer than 5,000 of them. In years when the waters creep shoreward through the rushes, higher and higher, inundating the beach and flooding their nesting places, they abandon the island. I have been on Lone Tree, on occa-

Herring Gulls, wary and generally vociferous, keep watch above their collection of nests on the Huron Islands of Lake Superior.

(All photos by the author)





sions since that first visit, when there were fewer than 300 birds there at the peak of the nesting season.

They were present in force the day I saw it first. Terns swarmed up from the beach as we waded through the rushes, black-capped, long-winged, graceful, white swallows of the sea, hanging in a dense eddying cloud above our heads, filling the air with their endless plaintive din. We had come to the largest nesting city of Common Terns on the Great Lakes.

Three of us spent the day there, photographing birds and nests and fledgling young, and banding the latter with the numbered aluminum anklets of the United States Biological Survey, later to be incorporated in the Fish and Wildlife Service.

We found no lack of birds to band. The beach was alive with young terns, some so recently emerged from the egg that they were still wet and bedraggled, some fluffy dry chicks that scrambled over the rim of their shallow nest at our approach, still others big enough to run off and hide in the grass and weeds or elude us by swimming boldly out into the bay. I cannot recall now how many we banded, but I know we were limited only by the number we could catch and handle.

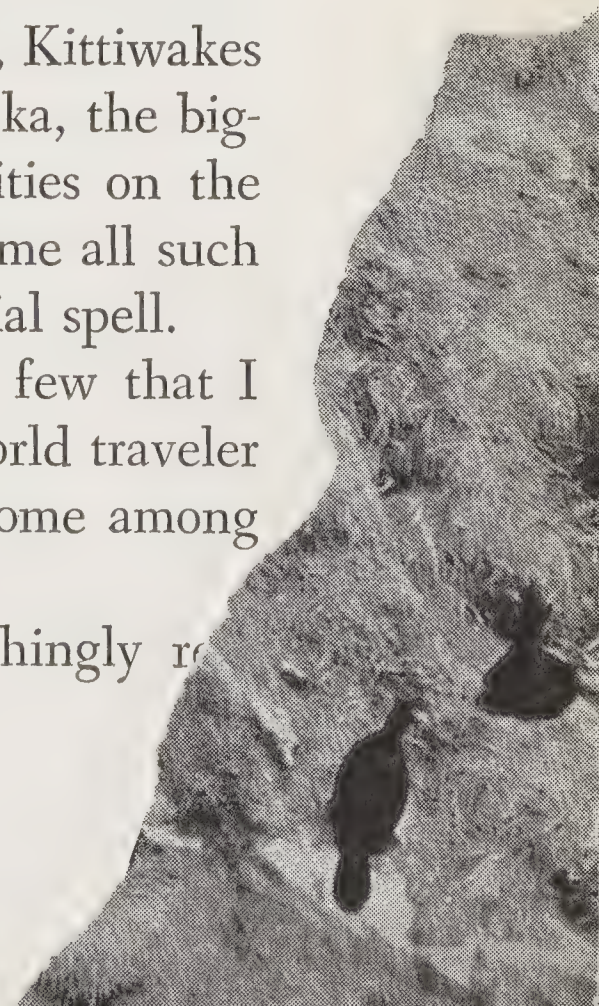
By the time we went back to our skiff late that hot summer afternoon I had come to the conclu-

This rocky, broken shoreline of Lake Superior is an ideal nesting place for gulls. Here they circle above a nesting colony.

sion that a seabird colony is one of the most fascinating spectacles in nature. That was many years ago and I have not changed my opinion. A crowded seafoal city, alive with noise and color and smell and motion, remains for me to this day an unmatched wildlife display. Since then I have seen many bird colonies larger and more populous than Lone Tree. I have visited the nesting places of Caspian Terns and Herring Gulls on the Great Lakes, and seen a tawny summer-yellow meadow on Bogoslof Island in Bering Sea dotted with the slovenly nests of big Glaucous-winged Gulls. I have watched the great mixed colonies of Murres and Auklets, Puffins and Cormorants, Kittiwakes and Fulmars, on the sea cliffs of Alaska, the biggest and most spectacular seafoal cities on the North American continent. But for me all such colonies, large or small, weave a special spell.

Of those I have seen there are a few that I remember best, of course, just as a world traveler remembers London and Paris and Rome among human cities.

There is, for example, the low, shingly re-





Kittiwakes nest on the steepest and sheerest of rock walls, for a very slight projection is all they need for attaching the nest.

called Shoe Island, in the Beaver group at the north end of Lake Michigan. It is a tiny dot of land in the empty and wind-stirred reaches of the big lake, no more than a pin-point on the charts in the wheelhouses of the big grain and ore freighters, 400 yards long and a fourth as wide, a wave-heaped reef of gravel that rises barely clear of the sea. Yet in summer, when the Caspian Terns come back to it to nest and rear their young, the lonely reef harbors not fewer than 10,000 breeding birds.

I know no other bird city anywhere more densely inhabited. Even the great communities of the Pribilofs, where Murres and Auklets, Puffins and Cormorants crowd the ledges of the sea cliffs in closed packed ranks and where the total population is numbered almost certainly in millions — no man has, so far as I know, ever

attempted a census there — do not outrank the Shoe Island tern colony for density.

The Caspians make no pretense at nest building. They do not even bother to excavate a shallow hollow. The eggs, grayish-olive or buff, with brown spots, most often two in number but occasionally one and more rarely three, are laid on the bare shingle in whatever site chances to please the fancy of the female tern.

I have known a summer gale, driving pounding seas high on the beach, to wash away and destroy hundreds of the eggs. In the early days,



The Murres persist in returning to Bogoslof, although eruptions of the volcano must have brought disaster to them in many seasons.

both the Beaver Island Indians and fisherfolk used to come to Shoe Island regularly to gather the eggs for food. Their method was to visit the place as soon as the laying season was under way, heap or destroy all the eggs in sight, and then return a day or two later and collect for the table. That procedure insured fresh eggs, and I have been told by the old Irish fishermen of St. James that tern eggs could not be told from those of domestic poultry so far as flavor was concerned.

The egg gathering reached such proportions that forty-odd years ago leading Michigan ornithologists predicted the certain extinction of the Shoe Island Caspians and other seafoal colonies on the Great Lakes if it were not halted. Apparently the practice died out shortly after that, however, and the birds nest and rear their young undisturbed now, safe in their lonely retreats.

Walking over Shoe Island in nesting time calls for extreme care to avoid trampling the unprotected eggs underfoot, since they are almost perfectly camouflaged as they lie among the egg-sized



pebbles. In July, when the breeding season is at its height, a man could walk from one end of the island to the other and crush tern eggs at every step if he chose to do so. The nests are no more than a pace apart the length and breadth of the reef and when the birds settle down at the nest sites they cover the whole island with a living blanket, almost touching one another with their long, pointed wings as they alight.

The effect is easier to imagine if you keep in

Red-faced Cormorants dot a steep hillside in the Aleutians, finding safe nesting sites where an intruder hardly dares to climb.

mind that they are among the most strikingly beautiful of all our seafoal, too. Not without cause is the Caspian often known as the Imperial Tern. He is big, averaging more than twenty inches in length and with a wingspread nearly double that. Snowy white underneath, with a pearl-gray mantle over his back, black feet and legs and a black cap on his head, his crowning glory is a strong, pointed bill of vivid coral red. I know of no sight on any beach more colorful than the great Shoe Island colony taking wing, rising with incredible grace against a background of deep blue sky and deeper blue sea, thousands of snowy, red-billed seafoal leaping skyward as if at a single sharp command.

For me it is one of the great and unsolved puzzles of that colony, and others like it, that each parent bird knows and identifies her own nest and her young after they are hatched. There is never any confusion or uncertainty on that score.

The island has little cover, only a sparse growth of low weeds, the seeds of which must have been carried there by the wind or on the feet of the terns themselves. When I first visited the place in the summer of 1926 there was not a blade of any green thing growing on it. In unprotected





The descriptive name of “little captains” is applied by the Aleuts to the Crested Auklets. These small birds nest in the cliffs or among the water-worn boulders tumbled at their foot.

locations the fledgling terns appear to suffer greatly from the blazing heat of the summer sun. Most of them desert the nest site as soon as they are able to run about and seek what shade they can find under a weed clump or beside a driftwood log. But no matter how they may be scattered, the old terns find and know their own families unerringly and display open hostility to any little stranger that comes around begging for a handout. Two of us once watched an adult Caspian, probably a female, that we could identify by a deformed foot, return time after time and give small fish, caught in the shoal water around the reef, to the same pair of chicks, one still in the nest, the other hiding under a weed some thirty feet away.

As often happens in bird cities, there is a minority group in this colony, and like many minority groups they do not have a happy time.

A few pairs of Ringbill Gulls make up this alien segment, and it is strange they should choose to nest there for there is a big colony of kinsmen of theirs, Herring Gulls, on neighboring Hat Island only a mile or so away. Certainly the Ringbills are more closely related to the other gulls than to the terns, but maybe they would fare even worse among their relatives — and know it. At any rate, they go on nesting in a little group by themselves at one end of Shoe Island, resented, always on the defensive, their young not daring to wander up among the Caspians.

Next to that crowded tern city I think the sea-fowl colony that is etched most sharply in my memory is a Pacific Kittiwake community on the cliffs of Whale Island, a short distance outside Kodiak harbor on Kodiak Island in Alaska.

The cliffs are a vertical wall of rock looking out over the sea, seamed and broken along their face by countless crevices and small ledges and jutting projections. It is on those narrow shelves that the Kittiwakes crowd their shabby nests of dry grass and dead seaweed.

The cliffs rise sheer from the boulder-strewn

beach some 200 feet to a grassy meadow of vivid green, the incredible green that characterizes much of the landscape from Kodiak westward through the Aleutians. The rock wall extends for almost a mile along the shore. And in nesting season all of that frowning barrier is white with Kittiwakes packed in close ranks. Anything that alarms a fragment of the great colony sends sea-fowl tumbling down from the cliffs in a living cataract and until quiet is restored they eddy out over the sea in a swirling white cloud like snow blown across a field on a blustery winter day.

Unlike most fledgling gulls, the young Kittiwakes must remain in the narrow confines of the nest until they are able to fly. Any straying over its rim, any tendency toward the juvenile exploring most young seabirds indulge in, would

send them tumbling to the rocks far below. It almost never happens that one falls.

We attempted to compute the number of Kittiwakes in that colony on the basis of the total area of the cliff face and the average amount of space each pair occupied. We could make only the crudest calculations, but I believe the population must run into the hundreds of thousands.

Spectacle that it is, however, it is dwarfed both in immensity and numbers by the bird colony that lives each summer on the sea cliffs of St. George Island, the smaller of the two Fur Seal islands in the Pribilof group in Bering Sea.

The cliffs of St. George rise a full thousand feet from the sea at their highest point and confront the stormy, fog-shrouded ocean for almost five miles in an unbroken wall of rock. And every



Agile, quick and sure-footed on the steepest slopes, Blue Foxes prowl the cliffs and raid nesting colonies in the Pribiloffs.

Tufted Puffin's nesting burrow might remain unnoticed in the tall grass, if the bird did not stand such grotesque guard.



shelf, ledge and projection on that great face shelters its quota of Murres, Auklets, Puffins, Cormorants and Red-legged Kittiwakes.

Crested Auklets, the "little captains" of the Aleuts, queer small seafoal with topknots curved forward over their bright red bills, nest in crevices and recesses in the cliffs or among the huge water-worn boulders at their foot. Paroquet Auklets, smaller and crestless, share the same locations. Puffins, the "old men of the sea," lay their single eggs far back in the crevices or excavate shallow burrows for themselves in the volcanic soil along the top of the cliffs, and stand for hours near the entrance to the nest site, staring watchfully out over the sea, solemn and a little ridiculous, like small caricatures of a pompous judge in a yellowish wig.

Red-faced Cormorants build their bulky nests wherever they can find a suitable spot, often on big flat-topped rocks down by the sea, where surf and tide boom and swirl endlessly only a few feet away. Murres far outnumber all the others. They cling wherever there is a foothold, laying their big top-shaped eggs on the bare rock on shelves so narrow it does not seem they could find room to brood. They crowd the ledges like white-fronted soldiers in close order drill, standing erect as penguins. They are slow to take alarm but if frightened sufficiently they dispel the illusion of really being small penguins of the north by pitching down to the sea in strong and rapid flight.

I overbalanced a big rock at the top of the cliff one July day and sent it bounding and crashing hundreds of feet down to the sea, and with the thunder of its fall a quarter mile of the cliff face exploded into life, a milling horde of birds that staggered the imagination. Population estimates are close to meaningless in such a place, but I am sure that on that towering wall and in the crowded Least Auklet colony in a big boulder field a short distance back of it, well over a million birds nest each summer. The little Auklets make their nests among and beneath big blocks of rock and their numbers are beyond counting or calculating.

There, as in the Shoe Island tern city and many other seabird communities around the world, egg gathering was once a common practice. The Aleut Indians used to clamber down or lower themselves over the cliffs to raid the ledges. On

Walrus Island, a low table of rock a few miles away, hidden beneath a carpet of seafoal in nesting season, the task was even easier. The Aleuts collected eggs there by the baidar load, a baidar being a big open canoe much like the umiak of the Eskimos. It was formerly the custom, too, of the Aleut boys to lie in wait at the top of the St. George cliffs and knock down the Least Auklets with clubs and nets as they came homing from their sea pastures in late afternoon, swarming above the rock wall like clouds of bees returning to the hive. But St. George is part of a federal bird reservation now, along with Walrus Island and the rest of the Pribilofs, and the seafoal and their eggs are safe from molestation.

Perhaps the strangest of the cliff cities of Alaska is the nesting colony of Murres on Bogoslof, the volcanic land dot whose beaches are also home to a huge breeding rookery of big yellow-brown Steller Sea Lions. Bogoslof is the peak of an active volcano building on the floor of Bering Sea and it has erupted and changed shape so many times in the last two centuries that the early Russians knew it as the disappearing island. The eruptions must have brought disaster to the great Murre colony many times, yet the birds return there persistently to breed, crowding every ledge of the cliffs and even nesting in densely packed masses on flat slopes of volcanic ash and debris.

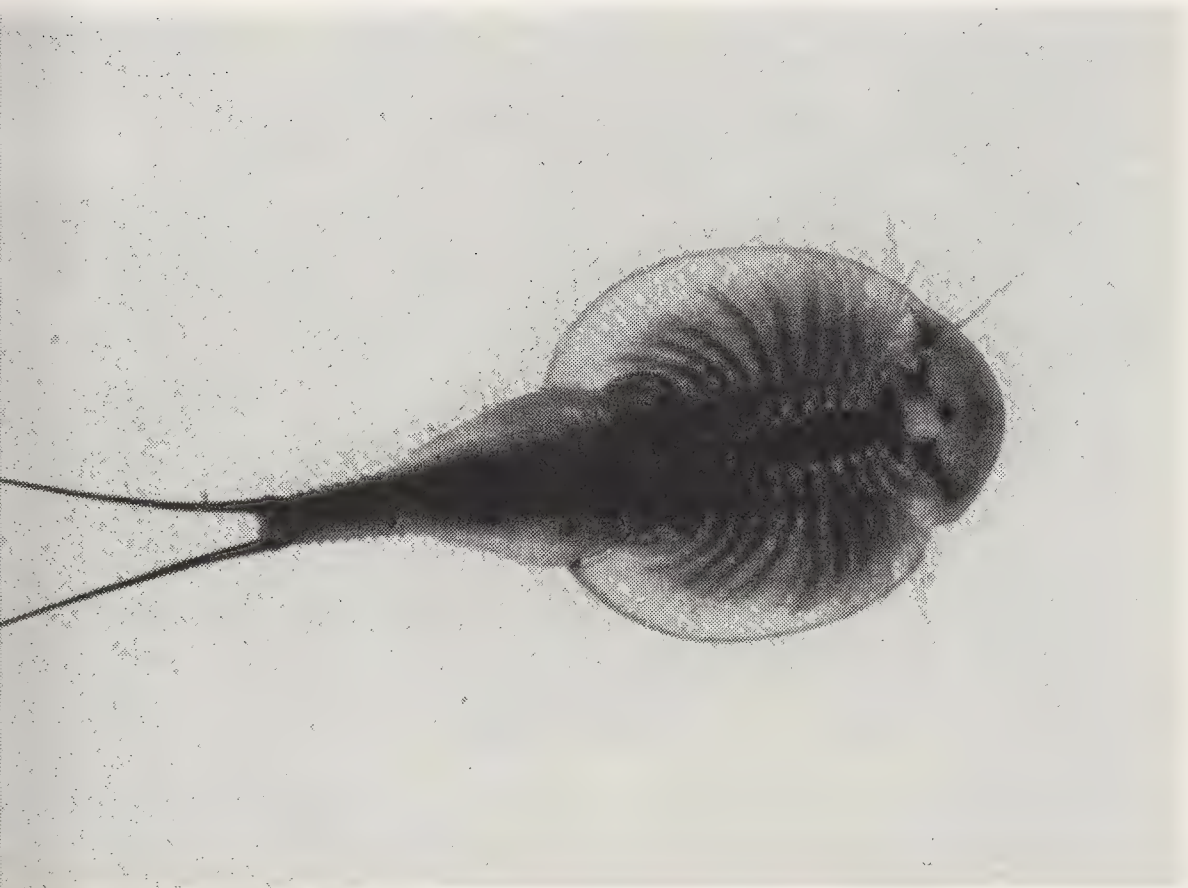
The Murres share their lonely island with a colony of Glaucous-winged Gulls, and where the sea wind comes sweeping in over the cliffs the gulls ride the air currents like graceful, effortless ships anchored in a stream, hardly more than arm's length away from the Murre ledges. They dare not raid as long as the sharp-billed Murres remain on guard but if an egg is left undefended they pounce and carry it away as a hawk takes a mouse.

A gunshot or any other loud and alien noise echoing off the Bogoslof cliffs sends a dense cloud of hundreds of thousands of Murres fleeing seaward in headlong flight. Here again it is useless to attempt to guess at numbers.

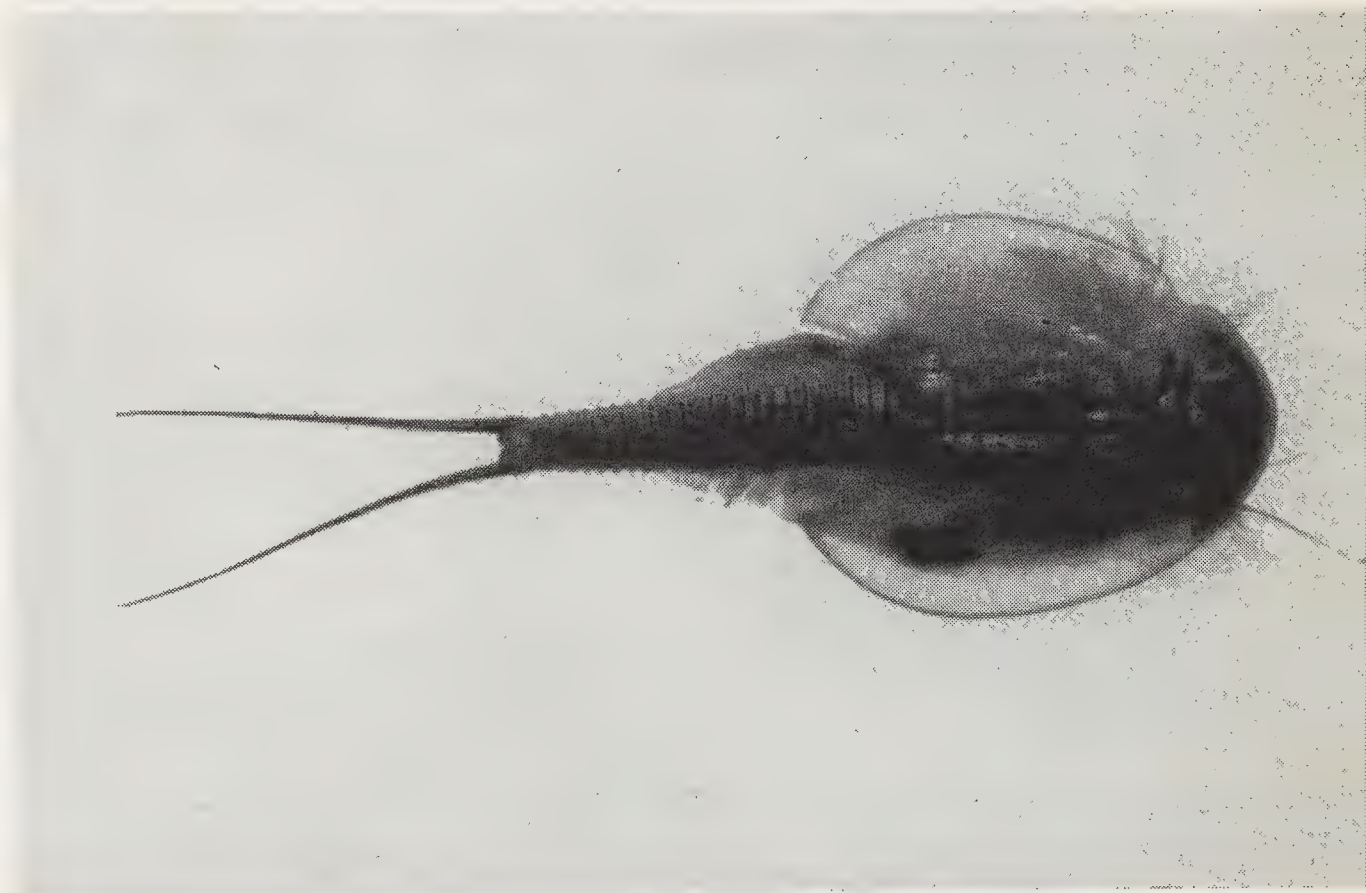
Cliff cities, reef cities, island cities — there is nothing outdoors more wonderful, more fascinating, more alive with the vibrant beauty of wild things than the crowded, busy nesting colonies of the seafoal!

Shrimp from the Desert

By MYRON GORDON



LEFT — The under side of the Desert Shrimp. BELOW — Seen from the top. These photographs are about twice natural size.



BEFORE THE DAYS of macadam highways below the Texas border, adventuresome motorists going south to Mexico City were obliged to trek across the great desert on the central plateau. Nowadays it is no great feat for the tourist to speed over the 800 miles of well-posted roads from Laredo to Mexico City in forty-eight hours, aided by fine gas stations and motels all along the way.

Back in 1930, with camping equipment and reserves of gasoline and water, we had to follow desert trails across the plateau. We had a job to do—collecting fresh water fishes and other aquatic organisms for Cornell University's Genetics Laboratory and for the University of Michigan's Museum of Zoology. After three weeks of collecting in the rivers along the coastal jungles of Mexico, we left the lowland plains for the uplands. Driving over the precipitous mountain trails we sometimes made thirty miles in a full day's stint before we reached the plateau and desert country. The going there was no better.

The desert was much like the sea. The sea has its waterspouts and the desert has its twisters of dust. I watched the birth of one dust spout as it emerged from a puff of wind that lifted some fine, powdery soil from the desert floor.

Like a phantom ballerina it began to pirouette. Spinning round and round, gathering speed, the mounting dust spot left the ground, rushed off and disappeared in the distance.

The desert sky was cloudless, but the winds created clouds of dust. It was fine, like talc, and it penetrated every crevice of the car, getting into our equipment, clothes, eyes and lungs. Toward evening the dust-carrying winds died down, but the heavy deposition of silt along the trail was violently uplifted as we drove by, and dust covered us again in brown clouds of our own making.

The Mexican desert is by no means continuously level. We drove through many narrow, steep-sloped mountain passes. Boulders, some of them larger than our car, rested precariously

on the slopes, and might easily have tumbled down upon us. Grotesque cacti in fantastic formations stood dust-covered along the way.

The trails crossed rough and badly weathered bedrock; the exposed cracks were wide, the fissures deep. In sandy areas, to get around eroded gullies across our path, we detoured along their outer rim until we found a gentle slope which would lead us into and out of them. These steep-sided gullies had been made over centuries of time by the infrequent heavy rains and cloudbursts which fell in the mountains farther inland. With little vegetation to hold back the waters, they had rushed across the desert, gouging out the dry, loose soil. Some of the gullies had been bridged with homemade planks, but after inspecting some of the flimsy structures we detoured anyway.

On the approaches to tiny villages, bullock carts with their six-foot-diameter, solid wooden wheels had cut deep ruts into the trails. Repeatedly the high, encrusted crown of the road scraped the precious oil pan of our undercarriage, sending ominous piercing sounds and thuds up through the floor board. To avoid the rutted road, we had to straddle the spinous cacti and century plants along the trail. That didn't work too well, either. Once we underestimated the size and toughness of an agave and as the front axle passed over it, it snapped back and lifted the floor board from its mooring, stalling the car. For days afterwards we pulled cactus spines from our punctured tires.

Along this arid, hot and dusty alkali-desert trail, Eddie Creaser spotted a pool of water that had seeped into a depression after one of those miraculous downpours that occasionally refresh the parched landscape. I could not conceive how any truly aquatic organisms could gain access to, or live, in such a temporary body of water. Yet Eddie insisted on taking our fish seine and exploring it.

"What in the world do you expect to get in a place like this?" I asked.

"You'll see."

A heavy stand of mesquite had grown around part of the pool, which was about twenty feet in diameter and only a foot or two deep. Eddie took one end of the seine, Ricardo, our assistant, took the other, and they waded from one end of

the pond to the other, pushing the net before them. I fretted at the waste of time.

As Eddie and Ricardo hauled their seine toward me on the shore line, I was amazed to see the multitudes of inch-long, tan-colored, many-footed creatures that emerged. One broad-headed and tadpole-like kind reminded me of the baby Horseshoe Crabs (*Limulus*) I used to collect along the sea beaches of Long Island. But Eddie, who in those days was in charge of the crustacean collection in the University of Michigan, said they were phyllopods, the branch-footed crustaceans or shrimp technically called *Apus*, found only in fresh water pools west of the Mississippi River. The second type of phyllopod was long and narrow and moved gracefully through the water on its back, like a trim racing shell rowed briskly by a varsity crew. I recognized that one as being a relative of the Fairy Shrimp (*Eubbranchipus*) which I had often captured in the icy pools of early spring in the hills at Ringwood near the Cornell University campus.

The potentialities of our desert pool was no surprise to Eddie, for it reminded him of those he had seen on Kansas plains where, too, a sudden rain would create a temporary pool. In an incredibly short time a teeming population of crustaceans would appear. How did they get there? Wading birds and drinking birds and mammals probably account for them, transporting the hardy eggs of the shrimp on their feet and fur from one pool to another.

Apus has the ability to hatch from eggs that have lain dormant in dried mud for long periods, sometimes for two years. The eggs are weather-proofed against desiccation by an impervious horny shell. When, after a long interval, a rare rain provides the water that seeps into natural basins where the eggs lie dormant, the eggs hatch within twenty-four hours, if the temperature is sufficiently high — about 85°F.

So constantly, over thousands of centuries, have the lives of the hooded Desert Shrimp been subjected to alternate long, dry spells and short, wet ones, that the eggs of some species will not hatch unless they have passed through a period of desiccation. Others require two or three successive seasons of drying and soaking before they are conditioned to hatch. One northern *Apus*,

subjected to winter frost, lays eggs that will not hatch unless they have previously been frozen and thawed several times.

Eventually getting the conditions they require, *Apus* eggs hatch into microscopic, branch-footed, almost transparent nauplii. These larvae in a short time transform into Desert Shrimp that look like tadpoles. When they reach adulthood, they are likely to be of one sex only, females. One phyllopodologist counted 5,796 *Apus* in a northern European pool, and all its members were females. Males of some phyllopod species are known but of others none have yet been found. Just the same, year after year, with or without males, the newly filled desert pools and those of the arid plains become well populated with phyllopods. The answer to this apparent riddle of life is that these crustaceans can produce themselves parthenogenetically. Some eggs

need not be fertilized, or activated by the male's sperm. The unfertilized eggs will hatch and develop into new creatures, repeatedly demonstrating the phenomenon of virgin birth in the animal kingdom.

The Desert Shrimp grow rapidly on bits of animal and vegetable detritus that are washed down and accumulate in their pools. Within two weeks they reach a length of half an inch and are mature, but they pay a price for growing up fast. For them life stops at forty days.

Their many-branched feet, which give them the group name of Phyllopoda, serve as oars. With their large, round, boat-like shells directed downward, they swim gracefully on their backs. On the muddy bottom of a pool they can turn over and, creeping along like horseshoe crabs, hunt for food in the soft ooze.

It was difficult for me to believe at first that a

The desert plateau of Cerritos, San Luis Potosi, is a waste of cactus and sand — certainly an unlikely spot to find shrimp.



Where rainwater accumulates, a shallow pool defies the drought. In these mesquite-shaded ponds Desert Shrimp are usually found.

temporary rain pool in the desert could provide a perfectly safe habitat for totally aquatic creatures. I thought that the inhabitants of such seemingly insecure homesteads would certainly soon become extinct. But Desert Tadpole Shrimp have been getting along successfully in an unstable world for a very long time. The palaeontologist, J. Salter, traced their ancestry through fossils back to Triassic times, some 200,000,000 years ago. Over the long geological epochs the *Apus* shrimps have changed little in their body design and mode of life.

Just a little more than 200 years ago, in 1752, J. Christian Schaeffer first coined the word *Apus* for the shovel-headed shrimp, calling it, in Latin, *Apus pisciformis, insecti aquatici*, for it seemed to him to be a fishlike aquatic insect without feet. No feet indeed! Schaeffer's term, *Apus*, is a prize understatement because the commonest *Apus* in North America, *Apus aequalis*, has 60 pairs of feet. This taxonomical malapropism has its match in the scientific name that Linnaeus gave to one of the most beautiful of all birds of paradise, *Paradisea apoda*. The fabled story was told that this remarkable bird, being always on the wing, needed no feet. This ridiculous notion was given credence in 1758 by Linnaeus who, examining dried skins of the birds, found no feet attached to them.

The ancient natural philosophers were either ignorant of the existence of creatures like *Apus* or unaware of their curious mode of life. Otherwise their sudden emergence from wetted mud in extraordinary abundance certainly would have provided them with a striking example of spontaneous generation. In modern times the lives and antics of the seemingly harmless Tadpole Shrimps have amused field naturalists keen enough to spot and study them.

But recently incriminating evidence has been brought against two species of *Apus* by the rice growers in Butte and Sutter Counties of California. In 1946, the Sacramento Valley farmers found that Tadpole Shrimps were attacking the

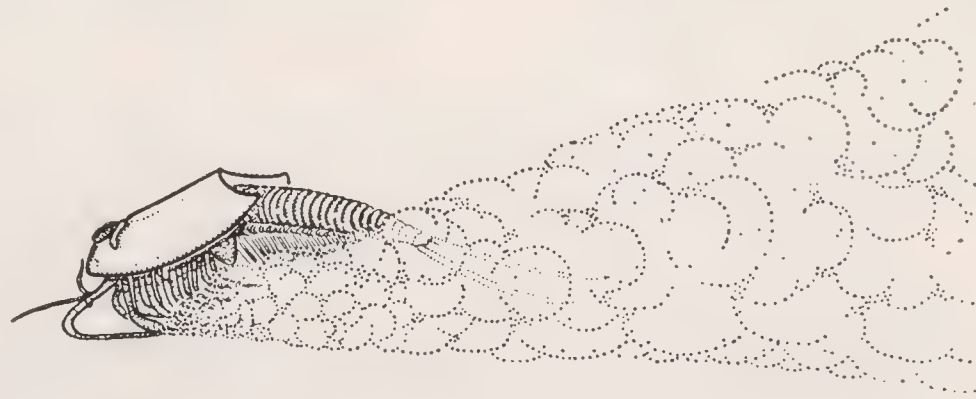
tender leaves of young rice plants. Air currents would then pile the severed and floating leaves into windrows against the dikes. The shrimp were also charged with stirring up the bottom silt and as a consequence of keeping the water of the irrigated rice checks in such a constantly muddy state that sunlight could not reach the rice seedlings. The young plants would not grow properly, for they were lacking in chlorophyll.

The rice farmers asked the California Department of Agriculture at Davis for help in this emergency, and the Department sent the Fairy Shrimp trouble shooter, Lauren E. Rosenberg, to find out what could be done. He reported that the newly impounded waters of the rice fields in California simulated the temporary pools that suited *Apus* life requirements perfectly.

In talking with the rice growers he found that some did not realize their fields contained shrimp and that others thought they were the tadpole stage of frogs. Others, who recognized the crustaceans for what they were, did not realize that *Apus* was the cause of their trouble.

Rosenberg discovered two ways in which the shrimp stirred up the mud. As they cruised about, foraging in the bottom ooze, they left a thick cloud of silt over and behind them. In the other way, *Apus* managed to make a mess of the rice paddyfields by thrusting its head end into silt and digging away like "a dog digging for a rabbit." The digging of thousands of *Apus* not only fouled the water but also loosened the seedlings from their moorings. The young plants that survived uprooting were chewed and defoliated.

Before Rosenberg got through with his investigation he had worked out a copper sulphate control for *Apus* when they reached pest-proportions. It is not likely this is going to affect the lives of *Apus* generally. Tucked away in desolate areas of the world, their hardy eggs that have repeatedly survived the ice of winters, and the heat of summer suns of two hundred million seasons, will burst into life again in each succeeding spring — weather permitting.



A cloud of fine silt, suspended in the water, marks the digging of *Apus* in California rice paddies. (From Rosenberg).

Some of our

BIG CATS

Photographs by SAM DUNTON

*Rajpur, a magnificent Tiger now
ten years old, is the father of
21 cubs born to his mate, Dacca.*





*Bagheera is that great rarity,
a really tame Black Leopard.
He was 9 years old this spring.*

Juanita, the Jaguar, will be 4 years old in mid-summer. We hope to have cubs eventually.



Measuring the Speed of a Rattlesnake's Strike

By WALKER VAN RIPER

Denver Museum of Natural History

THE FASTEST THING in nature" is a typical statement about the speed of the rattlesnake's strike, and the notion that a snake can dodge a rifle bullet is widespread and persistent. In the course of experiments with the Prairie Rattlesnake extending over a number of years and aimed at analyzing and recording the nature of the strike by means of the high-speed electronic flash invented by Dr. H. E. Edgerton of M. I. T., I have observed the action at close quarters probably at least a thousand times. It has always seemed to me to be exceedingly fast.

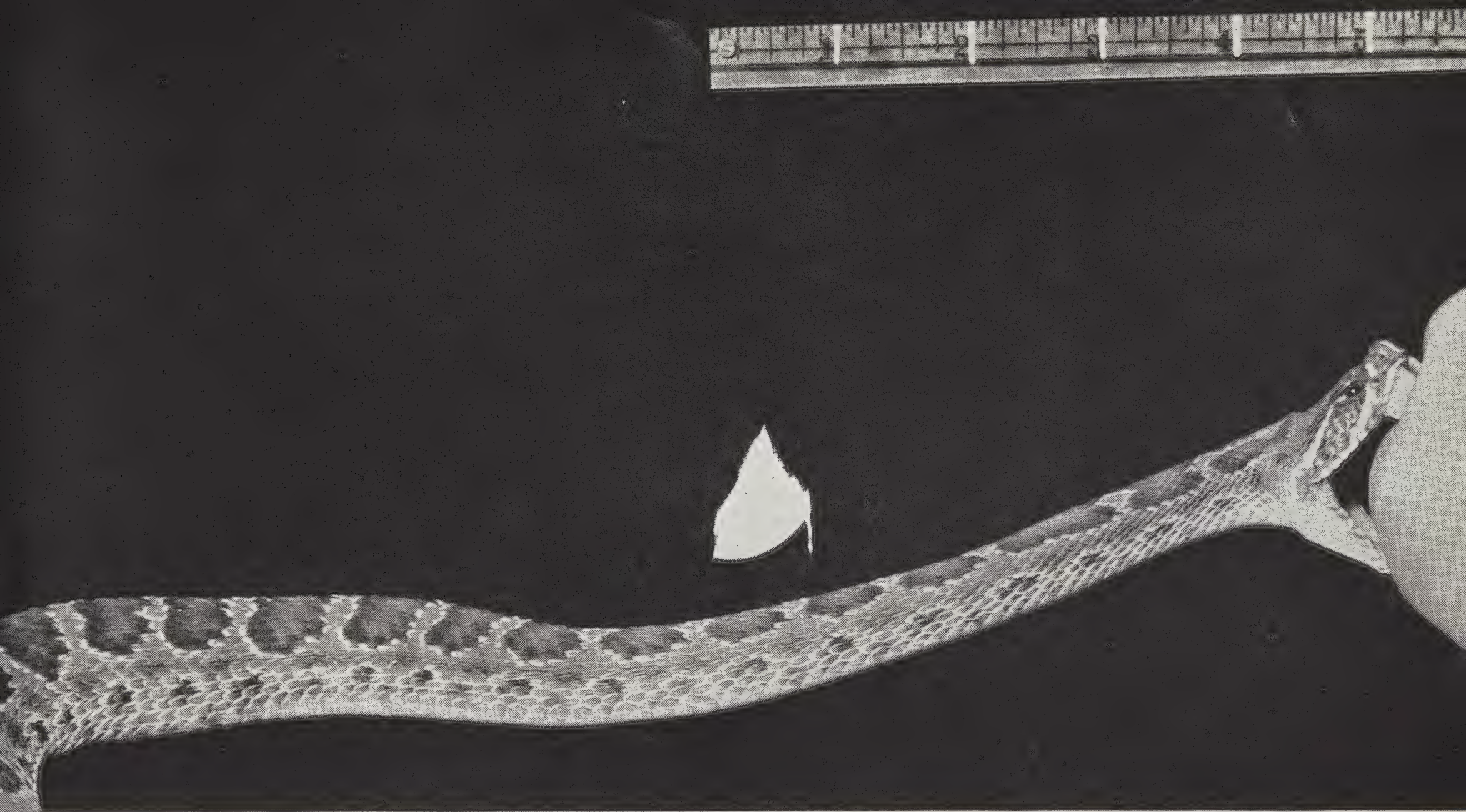
An experimental set-up for determining the speed of the strike is simple enough but many difficulties connected with the handling and behavior of the subjects and with the working of the apparatus had to be ironed out before a satisfactory series of records could be made. Reference to the illustration on page 52 will make the experiment clear. First, note the spot covering the serpent's eye. This marks the light source of an electric-eye beam which at this point is being cut by the head of the snake. The interruption of the beam actuated a relay which controlled two high-speed flashes, one set to go instantaneously, and the other after a delay of 20 to 30 milliseconds (thousandths of a second). The timer at the upper right is an electric clock motor with the clock gears disengaged and a white cardboard strip attached to the rotor. This was necessary in order to time the intervals exactly. Divisions of the timer scale are 1/100 of a second apart (10 milliseconds). Below the timer is a six-inch rule.

Measuring the results shown in the picture, we

see that the head of the snake moved forward toward the target (the soft rubber bulb at the right) 2.63 inches in 30 milliseconds. Making the calculation, we get a velocity of 7.3 feet per second. The average of 20 similar records, as shown by the table on page 53, is 8.1 feet per second, and it is interesting to note that 13 of these records fell between 6 and 9 feet per second. Certainly this is not "exceedingly fast." In fact, it is one of the slowest of the animal movements which we ordinarily regard as being fast.

The truth seems to be that we nearly always greatly over-estimate the speed of small animal movements near-by (they must be close to be seen at all clearly). Some years ago, for example, it was reported that the flight of a Deer Fly had been observed at a speed estimated at more than 800 miles an hour. A skeptical scientist, Dr. Irving Langmuir, thereupon tied a weight the size of the insect to a string, whirled it around at variously accurately timed speeds, and showed that the thing was completely invisible at a very small fraction of the reported speed. While this experiment did not measure the actual velocity of the insect, it demonstrated, in the simplest possible fashion, the limitations of visual observation and it emphasized the fundamental fact that measurements of this sort must be made either by comparison with some sort of speedometer or by accurate determination of the time and distance factors involved.

When I discussed my results with R. J. Niedrach, Curator of Birds at the Denver Museum of Natural History, he recalled that as a young man he was employed by W. C. Bradbury, an avid



collector of birds' eggs, his collection now being one of the prized possessions of our museum. On field trips, Mr. Bradbury liked to start an argument about the speed of the rattlesnake — which he could always do by maintaining that it was slow, not fast. If a snake could be produced, he would make a demonstration. Holding a sack or something of the sort in his left hand to attract the snake's attention, and a sharp bowie-knife in his right, he would clip off the head of the snake when it reared to strike. The experiment gave convincing evidence that the reptile's reaction time was too slow to dodge the knife, let alone the traditional rifle bullet.

That the human hand can move much faster than the serpent may be seen by the analysis of stroboscopic pictures taken by Dr. Edgerton in the early days of his invention. The illustration on page 52 is one of these. It shows Densmore Shute driving a golf ball. The interval between flashes in this picture was $1/100$ of a second and, using the known diameter of the golf ball as a unit of measurement, we can calculate that the head of the club at the bottom of the swing was travelling at a velocity of 108 feet per second and the hands of the golfer at 40.6 feet per second. This picture was taken with an apparatus and a method basically similar to that used with the rattlesnake.

The human fist being timed in the photograph

The full strike of a rattlesnake at a soft rubber bulb has been "frozen" by high-speed photography. The fangs are still sheathed.

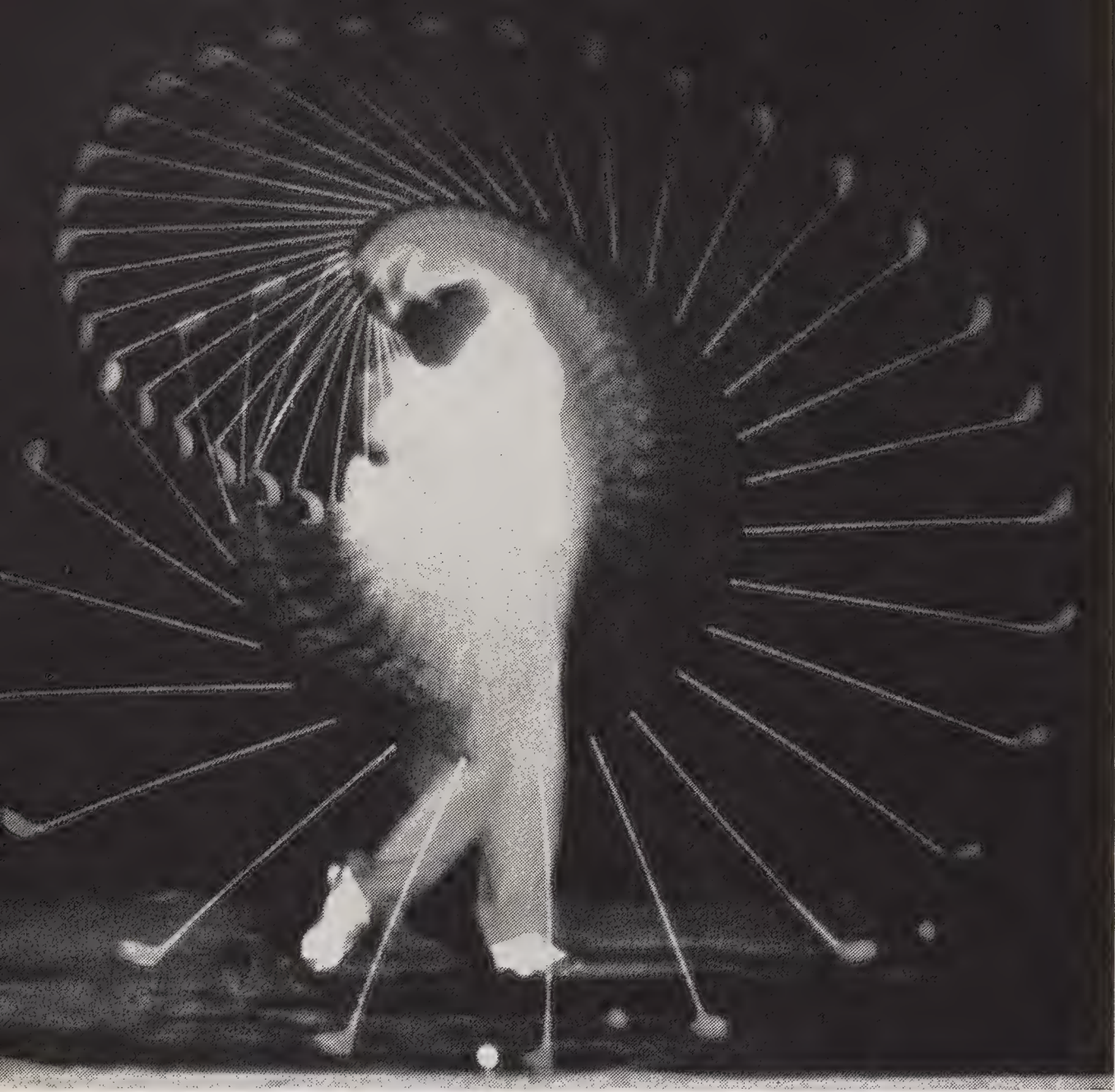
(Photos by the author unless otherwise credited)

on page 53 is not that of Rocky Marciano but the arthritic left jab of this writer, and the apparatus employed is exactly the same as that used to time the rattler's strike. The speed shown is 18.1 feet per second, better than twice that of the serpent, and it is safe to say that Marciano could beat it by a factor at least as great as 3 or 4.

In a ten-second hundred-yard dash a runner moves at 30 feet per second, and for a man to walk at the rate of 4 miles per hour, 5.8 feet per second, is no trick at all. This latter is four times as fast as a Bull Snake can crawl and more than 30% faster than the speed of one of our fastest snakes, the Western Whip Snake — which travels 3 miles per hour, or 4.4 feet per second, according to C. L. Pope in "Snakes Alive."

A familiar rationalization of the fear of spiders is that "they move so fast," and a leading authority on the spiders says of the Running Spiders that they go at "great speed." Dr. W. S. Bristowe, the British araneologist, timed the fastest spider known to him. It moved 330 times its own length in 10 seconds. This figures out at a rate of 2 feet per second.

According to Imms ("Insect Natural History") the honey bee flies at 5.7 miles per hour, 8.3 feet



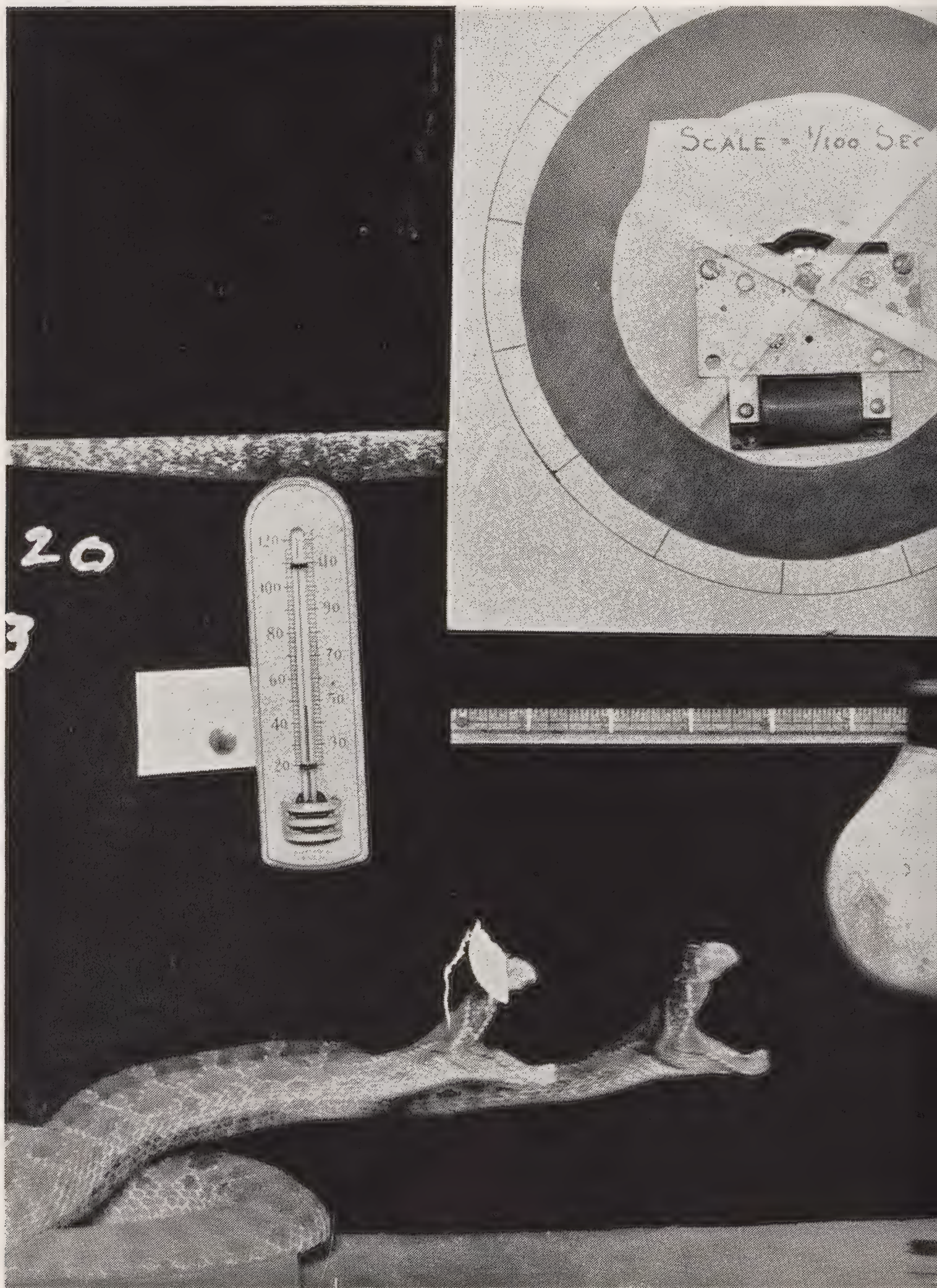
Densmore Shute's hands were moving 40.6 feet a second in this fast shot of a golf stroke.

(Photo by Dr. H. E. Edgerton)

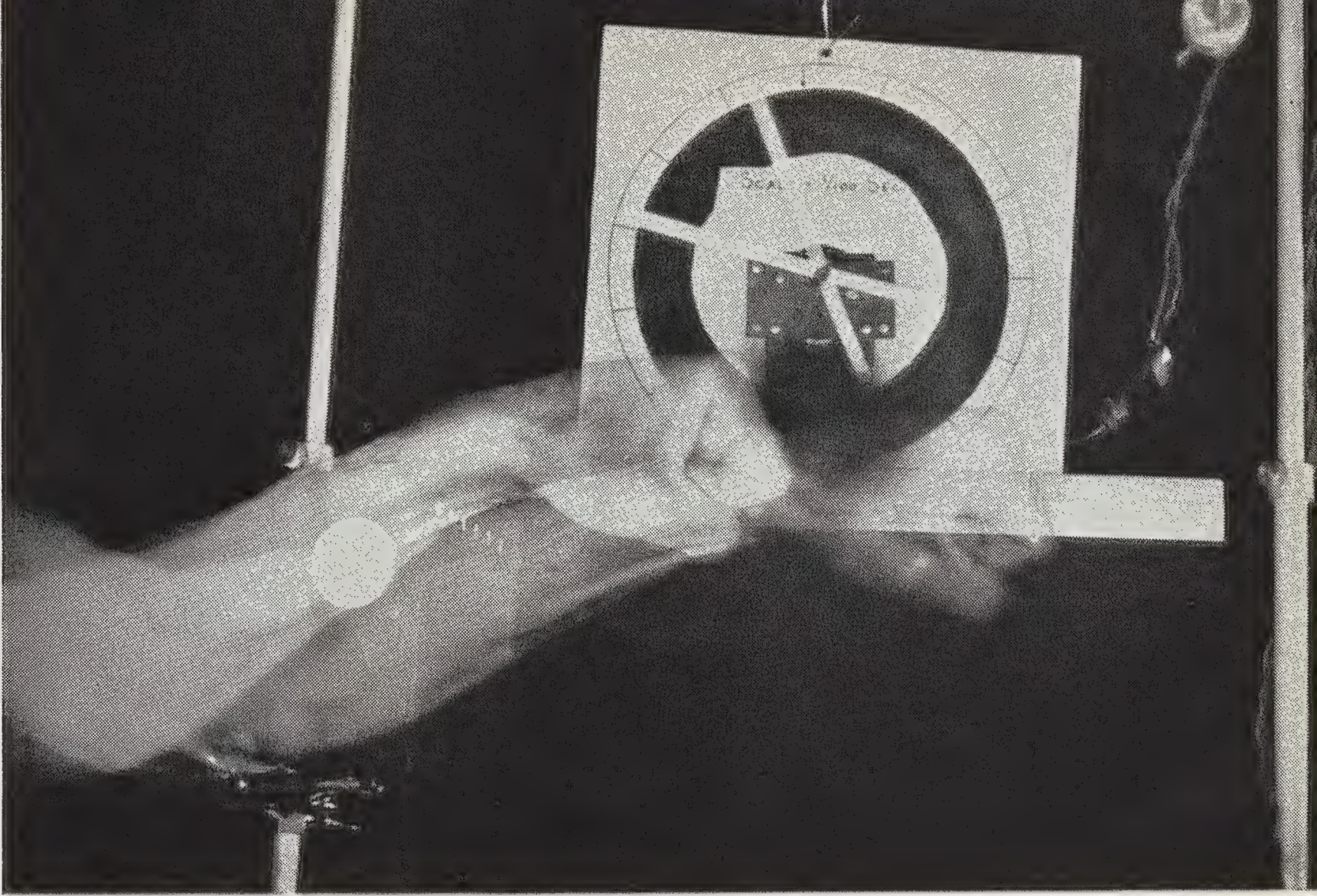
per second. And the fastest insect in his table, a dragon fly, moves at 15.6 miles per hour, or 22.7 feet per second, about three-quarters as fast as a man can run.

Gray ("How Animals Move") says: "When we walk along the river-side and catch sight of a trout darting through the water, we get the impression of very high speed. Different people make different guesses, but most anglers are inclined to think 15-20 m.p.h. is not unreasonable. We tried to check these guesses in the laboratory — with rather surprising results. A small trout (about 9 inches long) was put into a tank and allowed to settle down. Then a cine-camera above the tank was started up and the trout suddenly startled by a moving shadow. The fish moved at what appeared to the eye to be a high speed, but

This is how the speed of a rattlesnake's bite is measured. The apparatus is described on page 50. In this strike, the snake's head moved at a rate of 7.3 feet a second. Strikes were timed at various temperature levels, but the variation in speed did not seem to be particularly great.



The author's fist, making a jabbing punch, moves more than twice as fast as a rattlesnake. A boxer could jab much faster.



when the photographs were developed and analyzed the speed was found to be no more than 7 feet per second or 5 miles per hour. Here again it was found that the eye is a poor instrument for scientific observation."

If you watch one of the microscopic animals, such as a paramecium, it appears to swim quite rapidly. But Prof. Gray records the actual speed at about 15 feet per hour. Of course, the microscope magnifies movement as well as size.

To return to our rattlesnake picture, the tip of the pointer on the timer is moving around a circle 8 inches in diameter in 15/100 seconds, that is, at the rate of only 14 feet per second. Yet to the human eye it is a complete blur. If it were moving faster, it would still look much the same, as it is impossible for the unaided eye to make accurate judgments about blurs. And this may be the explanation of our fallibility in these matters.

The picture on page 52 shows the snake's head moving at near its top speed and that on page 51 shows the full strike. This subject was 32 inches long (about average for the adult Prairie Rattler in this area), and the total distance, out and back, covered in the average strike was about 24 inches. The total time of the operation can be estimated from the records at roughly 1/4 second. There were variations in every strike because of the position of the snake at the start, the way the electric-eye beam was cut, and the position of the target, which had to be kept in motion to attract the snake's attention. The force with which the snake struck also appeared to vary. Nevertheless the results are accurate enough for our purposes.

Six snakes were collected for use in the experi-

ment. One of these, however, proved to be so much more aggressive and active in striking than the others that it was decided to use it alone. It is revealing of human fallibility that even after the speed of its strike was definitely determined, it still *looked* very fast to this experimenter.

SPEED OF ANIMAL MOVEMENTS	
Animal	Feet per Second
Paramecium Swimming	0.004
Bull Snake crawling	1.5
Spider running	2.0
Whip Snake crawling	4.4
Man walking	5.8
Trout swimming	7.0
Rattlesnake strike	8.1
Bee flying	8.3
Fist of writer	18.1
Dragon Fly flying	22.7
Hundred-yard dash	30.0
Shute's hands	40.6

SPEED OF PRAIRIE RATTLESNAKE'S STRIKE		
Date	Feet per Second	Temp. F.
10-25-53	7.25	76
10-25-53	7.1	76
10-25-53	7.65	76
10-26-53	8.56	65
10-27-53	7.9	60
10-27-53	7.3	87
10-27-53	9.25	87
10-28-53	7.8	87
10-28-53	10.9	75
10-28-53	11.6	75
10-29-53	6.7	58
10-29-53	10.4	68
10-30-53	5.9	60
10-31-53	6.7	55
11-1-53	11.4	82
11-2-53	7.8	65
11-2-53	7.95	59
11-8-53	7.3	48
11-10-53	5.2	70
11-12-53	7.3	68
Average	8.1	



LIBERTY'S LIGHT A LURE TO DEATH.—THOUSANDS OF BIRDS BLINDED AND KILLED BY THE FLAME IN THE STOVE HAND—THIRTEEN HUNDRED AND SEVENTY-FIVE PERISH IN A SINGLE NIGHT.

FROM A SKETCH BY A STAFF ARTIST.—SEE PAGE 134.

Migration Night — 1904

By WILLIAM BEEBE

This selection, written originally for ANIMAL KINGDOM, is taken from a recently published book by Dr. Beebe, called "Unseen Life in New York," published by Duell, Sloan and Pearce — Little, Brown.

TO WRITE HONESTLY and with conviction anything about the migration of birds, one should oneself have migrated. Somehow or other we should dehumanize ourselves, feel the feel of feathers on our body and wind in our wings, and finally know what it is to leave abundance and safety and daylight and yield to a compelling instinct, age-old, seeming at the time quite devoid of reason and object.

We are concerned here only with the Unseen in New York — the nocturnal aspects of bird migration. Most small birds migrate at night apparently with two outstanding advantages. The first is avoidance of attacks by hawks and other enemies, and second, the use of hours when feeding is impossible. Students of migration must blame these night activities for creating a mental hazard in themselves, of utter confusion. If all birds migrated in the daytime, migration might be explained, at least in part, as a matter of eyesight. Night voyaging upsets all such theories and we must admit we have no clear-cut explanation of how birds find their way through hour after hour, and night after night of darkness, and over hundreds and thousands of miles of land and sea.

In New York City there are three excellent methods of watching migration, and even if you

do not know one bird from another, you cannot help being deeply interested by the instinct which carries these frail little beings up into dark, cold, naked space, perhaps a half-mile above the planet.

Our first method is a daylight one and hence to be dismissed in a few words. It is the observation of hosts of the birds themselves, as at dawn they glide down from their lofty levels of flight to trees and bushes on the ground. Here, in the hours of daylight, they must find time for sufficient restorative sleep and a frantic search for insects — to refuel their little stomachs for the energy needs of continued flight.

The second method is unique and requires only patience, a deck chair on a flat roof or lawn, a pair of binoculars and a full, or nearly full moon. With the said moon at a reasonable elevation the procedure is simply to rest, relaxed, with eyes focussed through the glasses on the bright satellite, and await what luck and chance offer.

Perhaps already faint chirps have hinted of passing migrants, and perhaps we have let our imagination play with the results of sudden daylight illumination. The heavens would be pitted and flecked with hundreds and thousands of flying birds. This we can never hope to enjoy, but the moon cuts a narrow swath of illumination through the sky. From two hundred and forty thousand miles away, down to our very retina, the darkness of night is penetrated by a tube of light, brilliant and transparent to our vision.

Your eyes may be focussed on lunar deserts and craters, when a small black dot may be seen to pass across the disk. Another follows and somehow your eyes become focussed in mid-space, and the third dot is recognized as a bird. Your neck will ache, your eyes tire, but your imagination and enthusiasm cannot flag. The very next speck

migration-time tragedy at the Statue of Liberty, depicting Dr. Beebe's incident, was depicted in Leslie's Illustrated Newspaper" for Oct. 15, 1887.

may show a type of fluttering, or a looping dip which may identify the species or group. The birds in the moon will, forever afterwards, take precedence over the man-in-the-moon.

The third method of watching migrants follows.

Many years ago (50 to be exact, in 1904) I had a memorable experience watching birds on migration, high in the air, within the limits of Greater New York. In company with Mr. Madison Grant, Secretary of the Zoological Society, I obtained permission from the city authorities to spend a night in the top of the Statue of Liberty. This was about mid-May, a time when migration ought to be at its height. We caught the last boat to Bedloe's Island, and on its return trip it carried away the final sight-seer, reducing the population to the Superintendent, his assistant, Mr. Grant and myself.

My first activity was rather comparable to mountain climbing. It was not the actual mounting of one hundred and sixty-eight steps from the base to the summit, but the difficulty of toting a blanket, lantern, food and binoculars up the narrow convolutions of the circular stairway. I finally had to make two trips, and unloaded in the crown of the noble goddess. As if I were planning an assault on Mount Everest, I made my base camp in the crown and my advance perch or roost in the torch.

In early evening, a downward look toward the water of the bay, three hundred feet below, showed the wakes of tugs and steamers, stretching out in long, well-defined lines, intersecting one another like the strands of a gigantic, waving cobweb. The day had been clear, but as the sun sank lower, clouds collected, and soon there began that most wonderful of earthly sights — an ever familiar, ever new sunset. The sun became obscured but I knew when it sank below the hidden horizon by the sunset guns echoing from fort to fort.

Half an hour later the whole outlook had changed. After the beacon of the statue had been turned on, a feeling of complete isolation became very real, and the distant glimmering lights of the city made this sensation more intense. One felt suspended in midair with no apparent contact with sea or land.

I climbed the vertical ladder on to the narrow duckwalk around the torch itself and prepared

to take a short nap before beginning my migration vigil. Hardly had I closed my eyes when a new characteristic of the copper giantess became apparent — she swayed. I was told this oscillation was through a twenty-four-inch arc, back and forth, and that it had something to do with the safety stresses of the whole structure. As long as I remained conscious, the movement was soothing, somewhat like the swinging of a hammock. When sleep closed down, the mobility changed from oscillation to acceleration, and several times I awoke and sat up terrified, certain that the massive figure was hurtling to the ground. I have had a similar sensation three other times, in the midst of the sickening waves of violent earthquakes.

The night had suddenly turned cold, a breeze arose and I changed my pallet to the wooden platform at the head of the stairway. With the rising wind the hollow statue came to life. During the day, with many people passing up and down, the echoes would be confused and not particularly noticeable. With the absence of humanity and the presence of a wind, the sounds became weird and awesome. I dropped a loose bolt which I had picked up, and the reverberations increased by echoes and distance, until, from far down, they sounded like thunder on distant mountains. The scratching of a pin was taken up and magnified until the squeakings died out in uttermost coppery hollows. When I laughed and shouted aloud, there resulted a pandemonium of tortured devils yelling back at me. Long after all seemed quiet, a faint squeak, squeak, came softly to the ear, perhaps a mouse feeding on crumbs dropped by some sight-seer.

At eleven o'clock I mounted again to the torch. The wind had quieted down, but haze was drifting up the bay and down from the sky. Every few seconds the sound of bird voices came from overhead; the peet-sweet of a sandpiper, the croak of perhaps a green heron, the thin notes of warblers and the more palpable chirps of sparrows. The haze changed to fog, and now, to the chorus of bird voices, there was added the occasional, distant, sonorous bass of a foghorn. Several times birds called from below my level, and then, without warning, something hurtled past my head, struck, and fell at my feet — a warm, palpitating but dying Magnolia Warbler.

The most surprising event of the entire night was a burst of song from two birds, heard a half-hour apart. The first, I am certain, was a Red-eyed Vireo. Five of the brief, thrushlike phrases came to my ear. The first was dim in the distance, three others were hurried and close, one as the bird actually passed almost within sight. The fifth was half lost in a foghorn. The second song was the unmistakable four-syllabled utterance of a Goldfinch. A single phrase came out of the fog, then the beginning of a second, apparently given as the bird passed, for the call rose into an indeterminate screech as it receded into the distance. I wondered at the emotion — a perfect example of displacement behavior — which prompted such an utterance under such inappropriate conditions.

As the fog increased and condensed in the warmth to almost rain, birds began to pass through the periphery of illumination, then to strike intermittently against railing and glass. I crouched low behind what protection I could find, to avoid being hit. One warbler flew against my coat and sank down panting. They came in waves, a few scattered birds, then a mob, swift and dense as a swarm of golden bees. All appeared bright and shining as they passed. Occasionally a dozen or more would seem to come in obliquely to the general line of flight, and at slower speed. In this case they would all keep on to the light, but put their feather brakes on in time, so that I would have five or six sparrows clinging to me unharmed, wings spread, heads back, panting.

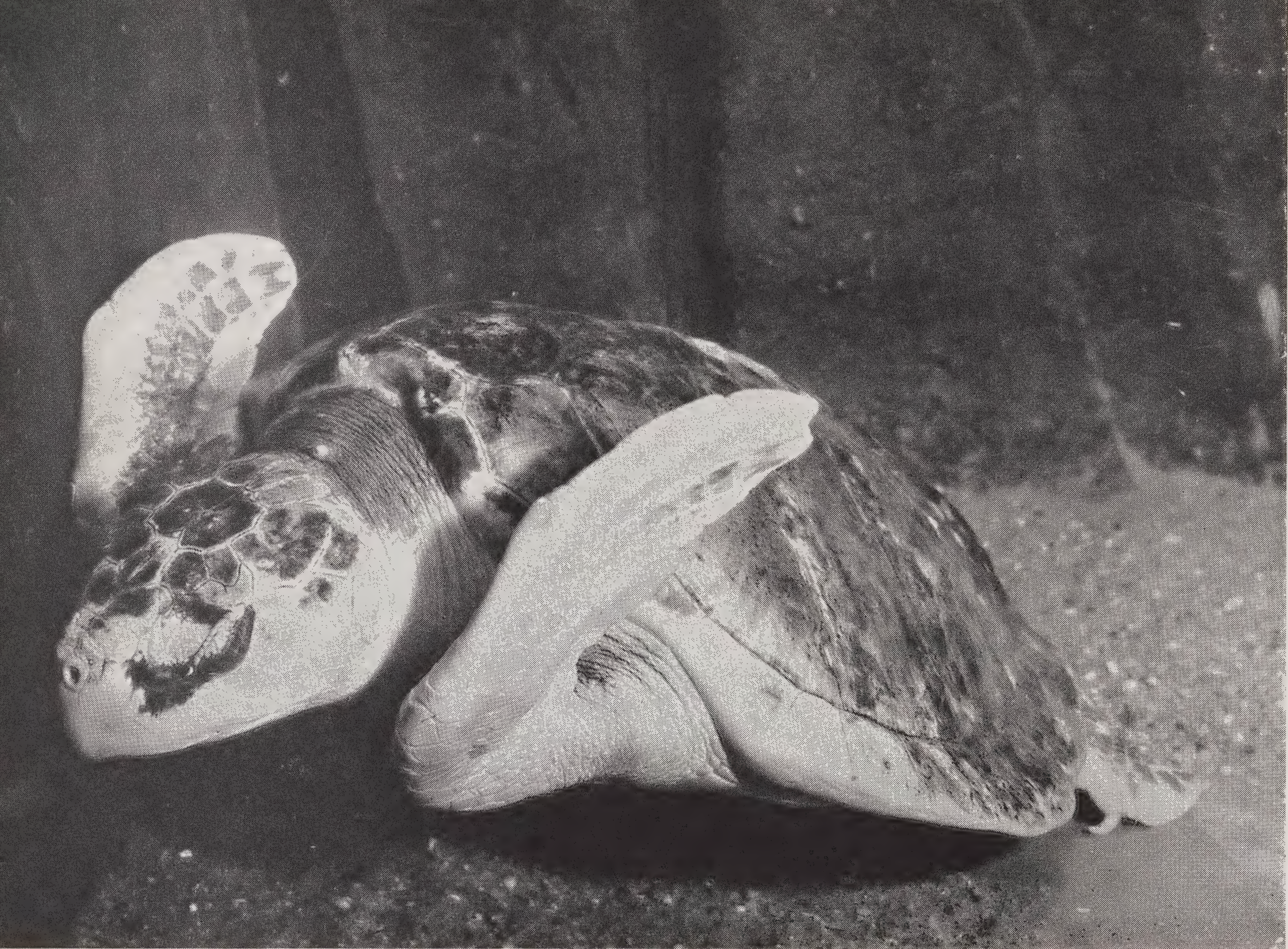
For the period of a few hours I was permitted to share the feelings and activities of birds on migration, sensing altitude, isolation, darkness, wind, speed and the awful confusion and dangers of light-in-fog.

At three o'clock in the morning the fog had lifted, and there was neither sight nor sound of a bird. They had flown down somewhere to a pre-

carious landing in the thinning fog, or had re-ascended to migration levels. I climbed again into the torch and watched for the first hint of dawn and life. The first came almost imperceptibly as a pale line of gradually brightening light; the latter was startling. A Herring Gull, all gray and white, swung swiftly toward me from the direction of the sea, shrieked when it saw my muffled figure and passed up river. The gull presented a double surprise for at this time of year it must have been a maverick of sorts, and should have been with its fellows on some distant breeding grounds. Prosaic tugs appeared and smoke arose from a hundred chimneys: a new day had begun over New York City.

I descended and joined Mr. Grant. He had been with me for an hour of migration watching, but after that had chosen to finish the night in a guest room at the foot of the statue. Later on, we picked up two hundred and seventy-one dead birds on the ground around base. We were told of one tragic night when more than fourteen hundred lost their lives. Thanks to the protests of bird lovers and especially half-dazzled pilots of passing vessels, the light of the statue was diminished and rendered indirect, so that, in more recent years, there have been very few avian casualties. A visit today to the great Statue of Liberty must be as memorable as ever, except that access to the torch is no longer permitted to the public.

In the intervening half-century Miss Liberty has witnessed many radical changes within her field of view. Perhaps the most spectacular are the non-migratory airplanes which roar past by day and night, guided by compass, radio, radar and other direction-finding gadgets. Far overhead numberless birds are still passing, exactly as they have for thousands upon thousands of springs and autumns, guided by means which still are a mystery to us.



Its eyes closed, our American Ridley lies asleep on the bottom of its tank. It can stay under for at least 50 minutes.

50-Minute

Nap Under Water

By JAMES W. ATZ

IF THE NUMBER of visitors lingering in front of our Atlantic Ridley's tank in the Lion House is any indication, this marine turtle is one of the most popular of aquatic exhibits. Actually, it is not a rarity, for the Atlantic Ridley *Lepidochelys kempi*, which is also known as Kemp's Turtle, is common in both deep and shallow waters along the southern Atlantic and Gulf coasts of North America. Occasionally it

wanders as far north as Massachusetts, and a few specimens have turned up in the British Isles, apparently carried across the Atlantic by the Gulf Stream.

Now, most people like to see activity in exhibition animals — running, playing, feeding — but with the Ridley it is the reverse. It seems to excite more interest when at rest than when swimming. A passing attendant is sure to be asked

what it is doing at the bottom of the tank. Is it sleeping? How long can it remain under water?

There seems little doubt that our turtle is resting and sometimes sleeping during the periods when it lies on the floor of its tank. Frequently it closes its eyes, and at such times it reacts quite sluggishly when disturbed.

But the answer to the question of how long it can stay under water was not easily answered, and so Curator-Aquarist Christopher W. Coates and myself stationed ourselves near the turtle tank, at times whenever we had a few odd moments, to keep a record of just how long our Ridley stayed below the surface without breathing air.

The problem of how long turtles can remain submerged and what enables them to stay down so long has not yet been completely solved. That turtles, even aquatic ones, breathe air by means of lungs, has been known for many years, but it has been relatively recently recognized that they can also utilize the oxygen dissolved in water, just as a fish does by means of its gills. Turtles have no gills, but instead they use the lining of the throat and sometimes the cloaca to extract oxygen from the water. Fluid is regularly taken in and forced out, thus insuring a fresh aerated supply at all times. Some sea turtles have been seen with their throats rhythmically pulsating, undoubtedly being employed in aquatic respiration, but we have rarely observed this behavior in our Ridley and never for any extended length of time.

Temperature is another factor of great importance in turtle breathing. Because they have no internal temperature-regulating mechanism, turtles resting in water take on the temperature of their environment. The colder it is, the slower the chemical processes going on in the turtle's body and the more lethargic it becomes. During the winter turtles become inactive. Freshwater species burrow into the mud at the bottom of ponds, lakes and streams and remain for months under water. At this time, however, their life processes must be at a distinct ebb and their oxygen requirements small indeed. But this cannot be true of marine turtles, since they never hibernate and are seldom found in water of less than 60°F.

At the old New York Aquarium Dr. George H. Parker, an animal physiologist from Harvard

University, once studied our collection of marine turtles to find out how long they remained under water. Forty minutes between breaths was the longest voluntary interval he observed, although by keeping a Ridley below the surface, he determined that this reptile could live at least an hour and a half without access to atmospheric air. One large Loggerhead Turtle that Dr. Parker timed in the Berlin Aquarium stayed under for 64 minutes, but during that time it seemed to be using its throat in aquatic respiration.

We know of no systematic observations on the breathing of marine turtles under conditions of nature. Nearest come those made by Dr. James A. Oliver, our Curator of Reptiles, at the Lerner Marine Laboratory on Bimini, B. W. I. He timed four specimens kept in large pens with numerous sizeable fishes. During his observation periods, they indulged in various activities but they all averaged two to five minutes between breaths. The temperature of the water was nearly 80°F.

The longest that Curator Coates or I ever saw our Ridley remain under water was 50 minutes, both of us recording this length of time more than once. Just to settle the matter of exactly how long our Ridley might sleep at one stretch I once stayed up all night, watching the creature continuously for eighteen hours. The longest "nap" she took (our specimen is a female weighing about eighteen pounds) lasted 50 minutes — the same as the longest taken in the daytime. During active periods, when the turtle was swimming about or nibbling on some seaweed that happened to be in the tank, she breathed 30 or more times per hour, but during periods of quiescence an average of 36 minutes passed between times of breathing. After remaining down for a while, the Ridley would commence to get restless, then come to the surface and take several gulps of air before descending again. The temperature of the nearly fresh water was 73°F.

The behavior of our Ridley brings up an interesting question. Do marine turtles ever normally sleep on the bottom in nature? There are several observations indicating that they can and do sleep at the surface of the ocean. Certainly they would not be able to reach the bottom while in the deep seas. There they would have to travel straight down a mile or more before reaching a solid resting place.



WILDLIFE IN ALASKA

A. STARKER LEOPOLD

F. FRASER DARLING

AT THE END OF 1953 a book called "Wildlife in Alaska" was published under the joint sponsorship of the Zoological Society, the Conservation Foundation and the University of Alaska. It is non-technical; a book for the lay reader. It was expected that in the normal course of things it would have a good reception from qualified critics and readers, for the authors were Dr. F. Fraser Darling, the Scottish ecologist now on the staff of the University of Edinburgh, and Dr. A. Starker Leopold, son of the late Aldo Leopold whose work in ecology is widely known.

Praise of the book that has poured into the office of the Conservation Foundation has far exceeded expectations, however. Here are excerpts from three recent letters:

"My reading in things Alaskan has been rather broad, but in none of it have I experienced anything to equal the stimulation and satisfaction which I derived from reading WILDLIFE IN ALASKA. The book is in a class by itself in Alaskan literature — a 'wild animal' book which also treats the problems of the Alaskan natives and discusses the broader aspects of the Alaskan economy and ecology with a depth of understanding, wisdom, originality of approach and clarity of insight rarely if ever found in either the more 'technical' or the more journalistic writings on these same subjects."

G. W. ROGERS, Economist on Governor Heintzleman's staff and formerly Chairman of the Alaskan Field Committee, U. S. Department of the Interior.

"I read this book last evening, the same day it arrived, as I am so greatly interested in the subject it covers. It is well done and should help very materially in getting more research on wildlife and wildlife habitat. I hope especially it will lead to a better public appreciation of the bad effects of forest and tundra fires on the Caribou of Interior Alaska and that this, in turn, will bring better fire protection.

"I wrote Dean Hosley of the University of Alaska today about this book, as I know of his interest in having the University do more research and promotional work on forest management and protection in the Territory."

B. FRANK HEINTZLEMAN,
Governor of Alaska.

"We have been delighted with Leopold and Darling's publication, WILDLIFE IN ALASKA. It means a great deal for us in Alaska to see the shrewd evaluation of Alaska's greatest resources described in an interesting and effective manner. The book appeals to many Alaskans who have felt basically in accord with Leopold and Darling's thesis but did not have their experience and skill in presenting the situation. It is being carefully studied here, and it is my estimate that it will bring forth a loud and strong set of statements from citizens who wish to preserve for their future and for their children the use and enjoyment of the natural resources which have been the support of Alaska up to this time."

DR. LAURENCE IRVING,
U. S. Public Health Service,
Anchorage, Alaska.

The scope of this study is well defined by the authors in their opening pages:

"Our task, as greenhorns spending four months in 586,000 square miles of territory, has not been to attempt to solve the problems of conservation in Alaska, but to make an objective appraisal of them. We have tried to evaluate the potential importance of the ungulate mammals in the future economy of Alaska and set their conservation and management against those other forms of land use which might loom paramount, such as pastoralism, forestry, or agriculture. We have tried to remember the several values of big game for recreation, esthetic appreciation, and tourist attraction, and last but not least for food. The animals exist, also, in their own right and we should acknowledge this as part of the national responsibility. We have been particularly concerned with the place of the big game species in the economy of the native peoples of Alaska and have therefore had to consider some of the sociological problems of Eskimos and Indians. An attempt has been made to define the broad ecologic problems and the more specific planning which will be necessary in the future."

Maps showing the past and present ranges of caribou, reindeer, moose and other wildlife in Alaska are included, along with 16 photographs of wildlife and their habitat conditions in Alaska. This study was published by The Ronald Press, New York City, and is available from the publisher at \$2.75.

News from the Conservation Foundation

Congressmen Ask for Osborn's Book

"The Limits of the Earth" will invade the U. S. Senate and House of Representatives at an early date as a result of the generosity of a friend of the Conservation Foundation. This gentleman made an offer to pay for enough copies of Fairfield Osborn's latest book to place it in the hands of every Congressman. It was deemed inadvisable to send the book "cold" to all these legislators. Hence, a letter was sent out asking whether they would be interested in receiving complimentary copies. There was considerable speculation at Foundation headquarters as to the size of the response to this offer, and estimates of the probable number of replies ranged from a low of 27 to a high of 400. To date 172 have indicated their desire to have the book and responses are still being received.

Educational Program Financed

By virtue of a generous grant from the Old Dominion Foundation, the Education Department of the Conservation Foundation will now be able to undertake a much broader work program than in former years, making not only a more aggressive effort in the field of formal education but also availing itself of the many opportunities existing in the broad areas of general public information or awareness.

Plans are being made to add to the staff an educator-catalyst who will start his work with a nation-wide survey of the extent and quality of conservation teaching at the college-university level. This survey would also include an analysis of job opportunities in conservation, the qualifications necessary to fill these jobs and the fitness of students now being trained for conservation work. The Foundation would hope by this means to determine by what methods and where new courses of instruction might be established in order to supply personnel now needed or soon to be required.

At the secondary school level it is proposed to publish and distribute the reports of results of the Teacher Training Course sponsored two years ago at Plymouth, New Hampshire. This report will be put in the hands of school board members and high school teachers throughout the country as a stimulant to conservation teaching in secondary schools.

The Foundation's new short teaching films will be available soon for use in primary schools. Their novelty of presentation should give them broad acceptance among teachers and pupils.

Beyond the schools and colleges it is planned to make a more direct assault on public consciousness by working through the press, magazines, radio and television via professional newscasters, columnists and other individuals not identified with the conservation movement, but sympathetic with it and influencing large audiences and their opinions. This part of the educational program would include the preparation of material for educational radio and television stations. Already plans are laid for conferences with important broadcasters to determine the most practical method by which the Foundation can supply them with newsworthy material as it develops.

The new educational program also includes plans for increasing the Foundation's services to industry and a further project for the determination of the best means of bringing conservation needs more tellingly to the attention of legislators at both national and state levels.

Yale Course Gains in Popularity

Dr. Paul Sears, who holds the Conservation Chair at Yale University, reports that applications for enrollment in the course now exceed capacity. Student interest in the work of the Foundation is so great that we are considering making suggestions of research projects, from time to time, in order to strengthen and increase this relationship.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

"A Penelope" Enters the Language

When Penelope, our female Duck-billed Platypus, was discovered last fall to be without offspring after giving every indication of having babies in her nest, we thought the matter was of considerable zoological and "human" interest, but did not suspect that she was contributing anything to the living English language.

Now we learn that she has entered into the terminology of one of the atomic energy laboratories. A biologist employed in that laboratory told the story to a member of our staff. For some time the technicians have been using small animals—rats, mice and guineapigs—for certain radiation experiments and have accumulated such a large body of data that they feel reasonably certain that they can predict the reaction of a given animal to a given dose. Their predictions *almost* always work out, but now and then an animal doesn't do what the prediction said it would. That animal, around the laboratory, they call "a Penelope."

Teachers Study the Zoo

The ninth In Service Course for teachers in the New York City schools started in the Zoological Park on February 16 and will continue to the end of May. Forty-nine teachers are registered for weekly talks and demonstrations by members of the staff. The aim of the course is to give the teachers sufficient background about the Zoo to enable them to conduct their own "guided tours" of the Zoo when they bring their classes to us.

Delicate—and Successful—Surgery

Eye surgery on wild animals presents so many hazards that it is seldom attempted. Our animal Hospital has, however, been apparently successful with two cases of cataracts, involving a Capybara and a Wood Rail. The former had cataracts on both eyes; the rail was incapacitated

by a cataract on one eye and pre-capture damage to the other, so that it was unable to find food.

Both animals were anesthetized and a cataract removed from each, with cortisone being administered post-operatively to reduce the inflammation. The Wood Rail has since been returned to a compartment with other birds and is able to find food and compete successfully with its mates. The Capybara, operated more recently, is making steady recovery and obviously can distinguish light and dark. If it continues to make progress, the remaining cataract will be removed.

Both operations were performed by Dr. Charles P. Gandal, the Assistant Veterinarian.

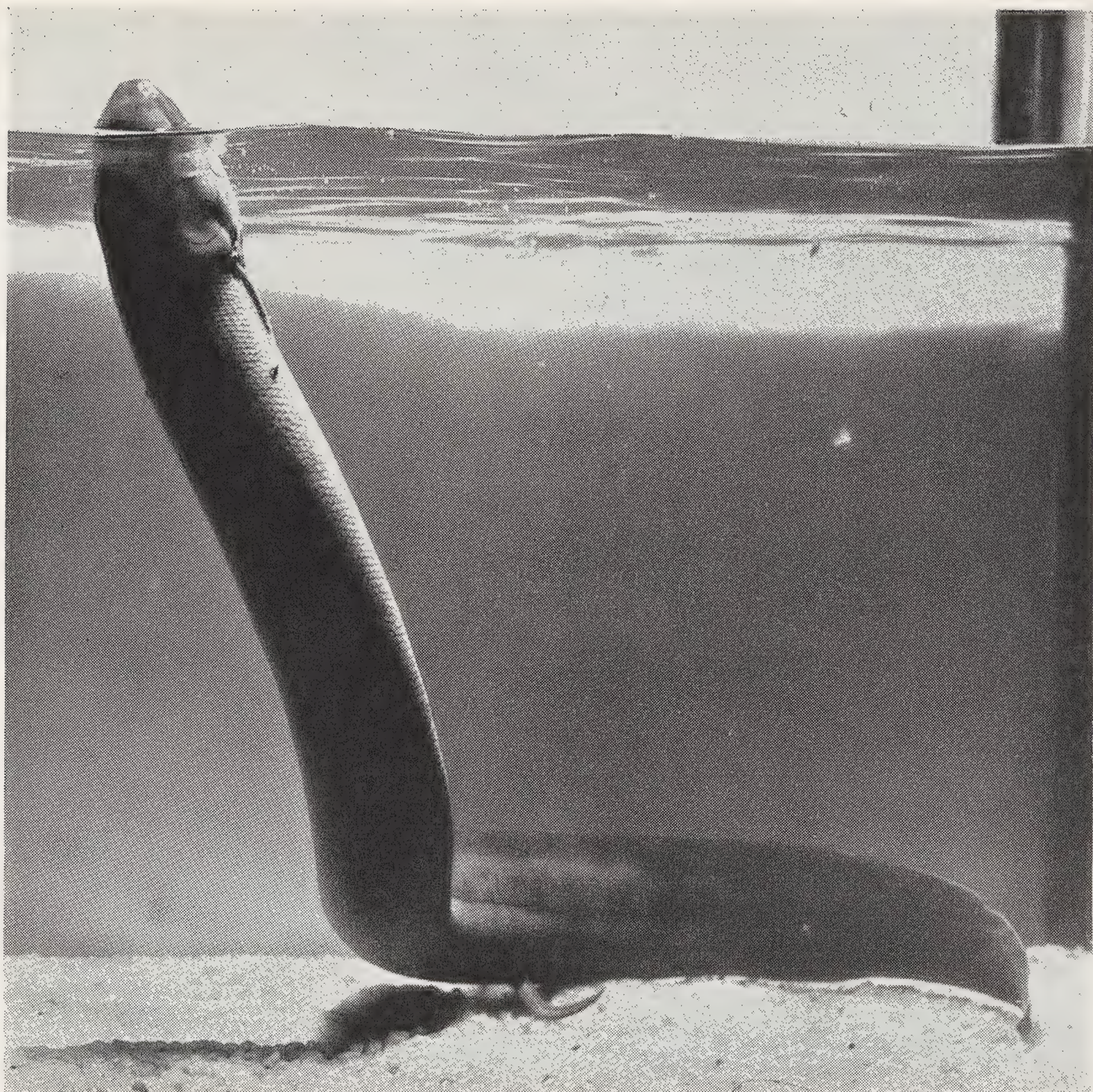
Nigrelli Contributes to Book

For many years "Bergey's Manual of Determinative Bacteriology" has been a basic tool of microbiologists, physicians and public health officers. The seventh edition is now in preparation and Dr. Ross F. Nigrelli, the Aquarium's pathologist, has been asked to write a section on the virus diseases of fish.

Miscellaneous Animal Notes

For the first time in many years we are exhibiting an Acouchy, or tailed Agouti (*Myoprocta acouchi*), from northern South America. It is in the Small Mammal House . . . A wild Opossum wandered into the New York Botanical Garden, probably finding its way down from Westchester County along the Bronx River, and was discovered in a tree on the afternoon of February 16. Mammal Department keepers netted it without much difficulty and it has been liberated in a state park far out on Long Island. Wandering Opossums and Raccoons occasionally get into the Zoological Park and raid the crane and goose paddocks . . . A male Hamlyn's Monkey and a female L'Hoest's Monkey have produced their third baby. Their previous offspring died within a day or two of birth, but the newcomer seems

This is the largest of our 5 new South American Lungfish, coming up for a gulp of air. It is 30 inches in length, in fine condition.



to be thriving . . . Our Blue Duiker collection is growing; a fourth youngster, a hybrid between a Simpson's and an Equatorial Blue Duiker, was born on February 11 . . . Nearly 11 months after it was hatched last April, a young Penguin (Blackfoot X Humboldt hybrid) has at last decided to grow up. For several months it was fed by its parents, and then Keeper Solanto had to take over and feed it by hand for several additional months. Now it feeds under water, of its own accord, like any well-brought-up adult.

After Years of Waiting

Although the South American Lungfish, *Lepidosiren paradoxa*, inhabits a large segment of the northeastern part of that continent, it appears to be rare in regions covered by professional fish collectors. Therefore when the Aquarium needs a lungfish for its collection, it frequently must wait quite a while before the request can be filled. For three years we have had a South American Lungfish on order with Paramount Aquarium, the largest tropical fish importers in the United States. Word had been sent out to all

the firm's far-flung collectors to be on the lookout for lungfish, but not until a few months ago was one turned up, finally to reach New York late in February.

Then, as so frequently happens with animal collecting, the pendulum swung from scarcity almost to plethora: the very next shipment from South America contained four additional lungfish! Now we are indeed well supplied with these unusual air-breathing fish. — J.W.A.

* * *

A new arrival from an unusual source is a Snowy Owl which fell down the chimney of a public school in Flushing. Fortunately the fire was out and the bird suffered no ill effects.

PUBLICATIONS OF INTEREST

THE WEB OF LIFE. A First Book on Ecology. By John H. Storer with an Introduction by Fairfield Osborn. 144 pp. 45 photographs. The Devin-Adair Press. N. Y. 1953. \$3.00.

Reflecting upon the nature of this mysterious Universe, Thomas Carlyle flung out this challenge:

"This green flowery rock-built earth, the trees, the mountains, rivers and many sounding seas; that great deep sea of azure that swims overhead; the winds sweeping through it, the black cloud fashioning itself

together, now pouring out fire, now hail and rain. What is it, aye, what? At bottom we do not yet know!"

Though John Storer would be the last to claim that he has found a conclusive answer, he has at least made a splendid contribution towards increasing our understanding of the interrelationships and the interdependencies of all living things with each other and with their environment.

His book pushes back the horizon. By exposing to our view the endless ramifications of the environment which surrounds and influences all life, including man's, his book has the possibly unintentional effect of putting man in his place and whittling him down to size.

One of the most impressive thoughts the author leaves with us is that the effect of man's impact upon the natural world has often been to trigger off a series of reactions, the consequences of which were not even remotely anticipated.

"The Web of Life" was written for the general reader who is interested in "the wise use of our soil and water, our forests and wildlife, and for everyone who would learn what has largely been forgotten in our machine age—how all living things fit together into a single pattern."

The text is not long; an average reader will require less than three hours to read it through. Some 45 excellent photographs, arranged in sequence, admirably illustrate many of the physical phenomena described in the text.

"The Web of Life" reads easily, partly because it is so well organized and partly because Mr. Storer's prose seems to be so effortless. But the intricacies in the pattern of The Web and the balance of forces which build, rebuild, and maintain its structure are not only immeasurably complex but often anything but obvious.

One of Mr. Storer's great virtues as a writer lies in his ability to analyze these complexities, without a trace of pedantry, and yet make their significance clear and meaningful to the lay reader.

I should be doing less than justice to this remarkable book if I failed to note that it carries overtones of possibly greater significance to the sensitive reader than the exposition of facts and their interpretation. Throughout its pages there runs a pervasive sense of reverence for the beauty of this living world as well as wonderment at the precision of its natural laws. This is why "The Web of Life" comes so near to providing an answer to Carlyle's challenge. — GEORGE E. BREWER, JR.

WHAT'S INSIDE OF ANIMALS? by Herbert S. Zim. 33 pp. Illustrated in color by Herschel Wartik. Morrow Junior Books, William Morrow and Co., New York, 1953. \$1.75.

Although ostensibly a "junior" book, this little volume is one that will serve as an introduction to zoology for every member of the family. Mr. Wartik's simplified drawings make basic anatomy clear and alternating pages of large and small type carry readable information for all age levels. The informative potentials of this little book are impressive. — L.S.C.

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LVII JUNE No. 3
1954

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Prelude to an Odyssey

THIS BRIEF EDITORIAL contains a confession. For a number of years we have felt a strong sense of delinquency in not discovering a way of adequately conveying to those who contribute financially to our institution the invaluable consequences of their generosity. It is one thing for a person to make a contribution and yet another for the donor to gain the satisfaction of knowing that the money has been spent fruitfully and effectively. An incident occurred recently which gave the needed spark to overcoming this delinquency and which, we hope, will also illuminate the varied and interesting ways in which contributions to the Society are used.

The incident was this: Forty-four years ago it happened that a member made a contribution to be used "in any part of the United States and our country's possessions wherever there is the most or special need for enlightenment or protection of bird-life." This was a relatively small fund of a few thousand dollars which through the years has been kept intact and from whose income expenditures have been made from time to time. Last month the opportunity was presented to join with our sister-institution, the National Audubon Society, in acquiring practically the last remaining stand of virgin cypress on a property in Florida, located in Collier County in the southwest part of that State. This area, with all of its associated animal and plant life, includes a historical rookery of some 12,000 wood ibises and egrets. With the aid of a nice balance of accrued income in the above fund, combined with some other funds available for wildlife protection purposes, we were able to join in the acquisition of the property, which will be established as a permanent sanctuary for the enjoyment of both birds and people.

In the evening of the day when this incident took place, the thought occurred how gratified this donor, who died a number of years ago, would be to realize that this gift had provided the means of helping to bring into actuality such a desirable result.

In thinking of the matter a little further, it became evident that there are countless other cases where contributions to our Society have proved of immeasurable value. Consequently, a series of brief editorials will appear in later issues of this magazine which will attempt to illustrate some of the creative purposes to which our funds are dedicated. The title for this series has not been selected as yet. Perhaps it should be called "Odyssey of Money."

Fairfield Osborn

SNAKES THAT SPIT THEIR VENOM

By CHARLES M. BOGERT

*Curator of Amphibians and Reptiles
American Museum of Natural History*

AROUND THE TURN of the century Goring Jones, a British Army officer in Burma, wrote that "yesterday evening as Lieut. Gibson of our regiment was going to his quarters to dress for Mess he saw a snake at which he proceeded to throw a stone. He then called for a light and a stick, and as he was bending down with the light to look for the snake, it made a dart at him but fortunately missed its aim. Some of the poison or saliva, however, was ejected into Lieut. Gibson's eye, causing instant and great pain, and the eyelids and parts swelled up quickly to the size of a hen's egg. The snake was killed, and found to be a small black cobra about three feet, four inches in length. Lieut. Gibson went to the hospital and after a painful night recovered his eyesight."

Goring Jones reported the incident with fair accuracy, but he was wrong on one count. The snake had not "missed its aim." Also, from what we now know of Spitting Cobras, it seems doubtful whether the snake actually made a dart at the unfortunate lieutenant. This was probably surmised in an effort to account for the venom's having gotten into the eyes of the officer. Observations made under more favorable conditions than the dim light of an army lantern fifty years ago indicate that when a Spitting Cobra sends forth its blinding venom the snake's head is not in motion. Movement would interfere with the aim, and there is every reason to believe that the cobra directs the venom with a fair amount of ac-

curacy. Moreover, the term "spitting" is misleading, since the venom is actually squirted. It may land on the face of an enemy up to twelve feet away from the snake.

However, this is the end of the story rather than the beginning. Going back into the published records we find that in 1827 one of the early scientific investigators applied the Latin name *sputatrix* to a Malayan cobra, presumably because he knew something of its peculiar habit. Since Africa is even better supplied with spitters, travelers in that continent must have learned of such animals at an equally early date. However, few Americans ever heard of Spitting Cobras until Colonel Theodore Roosevelt returned from his African adventures scarcely half a century ago.

There can be little doubt that the native populations in southern Asia as well as in Africa south of the Sahara Desert knew of Spitting Cobras many centuries ago. It is quite possible that such cobras were present in Asia, Africa and Europe before man's ancestors were walking upright. Today there are no cobras native to Europe, but their fossilized bones have been found in middle Miocene deposits in France that were laid down at least twenty million years ago. In fact, the upper jaws and the fangs of these fossil cobras are virtually identical with those of the Egyptian species that inhabits much of Africa and part of the Arabian peninsula at the present time.

This species is not a spitter, however, and we may never learn precisely when there appeared

on the scene snakes that could expel their venom to a distance. At present we can recognize seven distinct kinds or species of "true cobras," those that belong to the genus *Naja*. (The name, incidentally, is a corruption of the Hindu word *naga*, recognizable to many as the source of the name Nag, in Kipling's famous mongoose story). Three of these are confined to Africa and three to Asia. The seventh, the Egyptian Cobra mentioned above, is shared by the two continents. This makes a nicely balanced array, more especially since one of the three in each continent is of the spitting kind.

In addition to these "true cobras" there are some other venomous snakes that raise the anterior part of the body to an upright position, usually distending the ribs behind the head as they do so, thus spreading

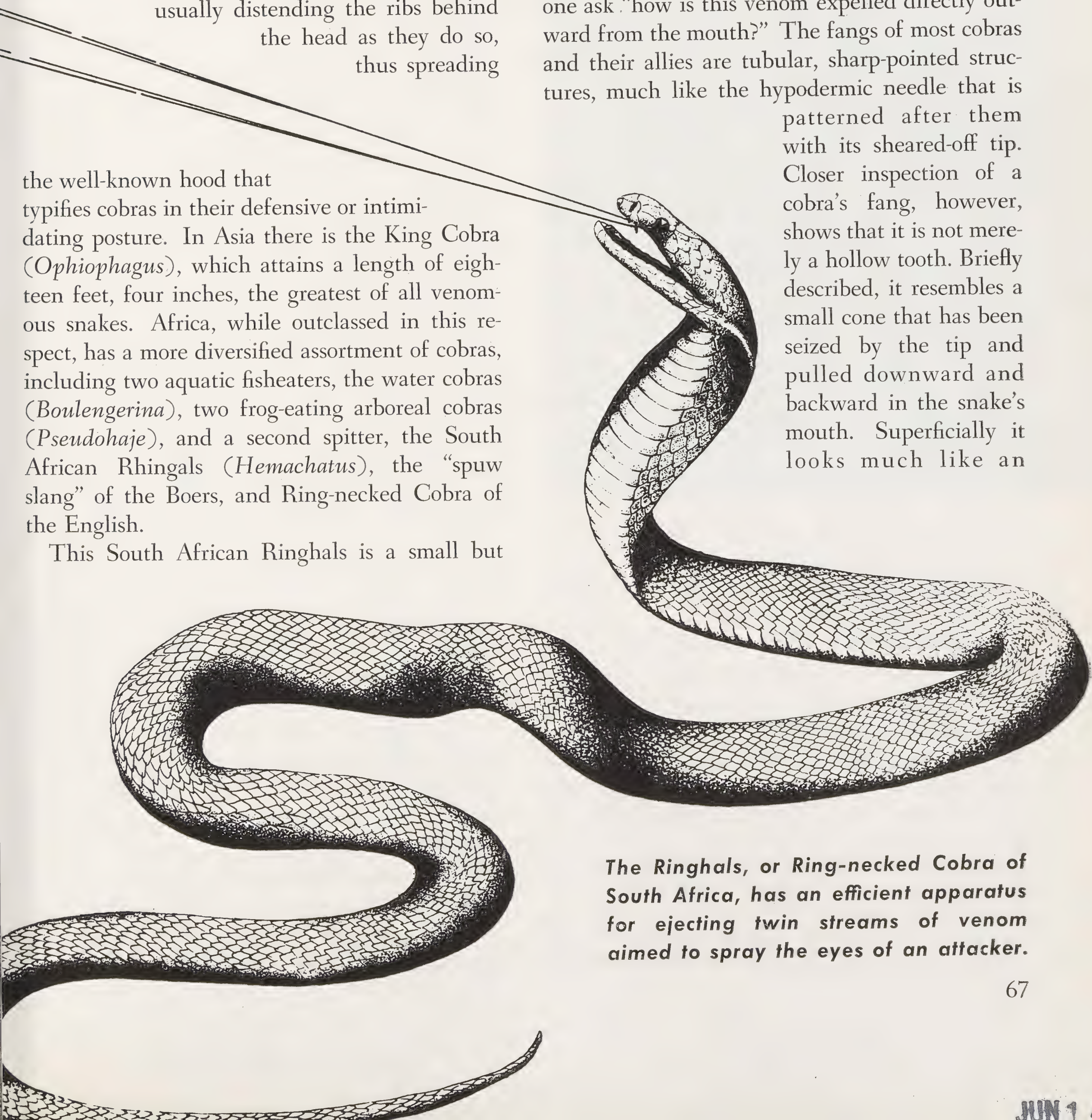
the well-known hood that typifies cobras in their defensive or intimidating posture. In Asia there is the King Cobra (*Ophiophagus*), which attains a length of eighteen feet, four inches, the greatest of all venomous snakes. Africa, while outclassed in this respect, has a more diversified assortment of cobras, including two aquatic fisheaters, the water cobras (*Boulengerina*), two frog-eating arboreal cobras (*Pseudohaje*), and a second spitter, the South African Rhingals (*Hemachatus*), the "spuw slang" of the Boers, and Ring-necked Cobra of the English.

This South African Ringhals is a small but

notoriously efficient spitter with a spectacular blackish colored hood, usually with a white band below it to which the snake owes its more widespread vernacular name. When lying prone and undisturbed it is not without resemblance to the harmless Hognosed Snake (*Heterodon platyrhinos*) of the United States, in having a slightly upturned snout, and even in some of its habits. For it employs the same trick of playing 'possum, rolling over on its back, but still keeping a wary eye on the intruder. Let the attacker beware! Should he approach too closely, the Ringhals can send forth two jets of venom that are aimed at the eyes, even when these are high above the snake, as they are in a man.

It seems strange that not until recently did anyone ask "how is this venom expelled directly outward from the mouth?" The fangs of most cobras and their allies are tubular, sharp-pointed structures, much like the hypodermic needle that is

patterned after them with its sheared-off tip. Closer inspection of a cobra's fang, however, shows that it is not merely a hollow tooth. Briefly described, it resembles a small cone that has been seized by the tip and pulled downward and backward in the snake's mouth. Superficially it looks much like an



The Ringhals, or Ring-necked Cobra of South Africa, has an efficient apparatus for ejecting twin streams of venom aimed to spray the eyes of an attacker.



The spread hood of the Ringhals is a gesture of intimidation, but it can be quickly backed up by a shot of venom. The cobra can “reload” and “fire” several times in quick succession.

the outer wall of the fang, it is apparent that the tubular structure is not the result of any actual folding while the fang is being formed. From time to time snakes shed and replace their fangs as well as their teeth, and in any cobra it is possible to find fangs in several stages of growth. These reveal that the perfectly formed tip of the fang appears first as the dentine is laid down in the soft tissue on the inner side of the jaw. There are progressive additions to the tip, with the dentine steadily added to the walls in much the same fashion that a brick-layer adds bricks when he builds a chimney. Above the tip of the fang an opening is left for the discharge opening as dentine is added day by day. The process continues until the upper end of the tube is reached, where the entrance to it is left open, as dentine is deposited as though it were poured in a mould.

Growth in the fang is now nearly complete, and it lies in a horizontal position alongside the jawbone, in readiness to fill a socket in the jaw. This replacement does not take place as soon as the old fang drops out, however. All venomous snakes are equipped with paired sockets in each upper jaw, with a fang present in one and then in the other. Three replacements in various stages of growth are lined up behind each socket. After a fang has been in use for some time the bony substance around the base of it in the socket begins to be resorbed, probably carried away in a solution in the blood. After the bony substance is gone the fang drops out. Meanwhile, a fully formed fang has already moved into the adjacent socket. For a few days there may be two functional fangs in the same jaw. This alternate replacement allows time for the base or pedestal of the growing fang to be fully formed before the tubular tooth rotates in the tissue, and its base moves into place in the socket. Thereupon bony tissue is deposited around it and it becomes firmly cemented into place.

The venom glands in snakes are located behind each eye. They are usually almond-shaped, membrane-covered sacks, surrounded by muscles and filled with a network of tubules and the special

ordinary snake tooth, but it contains a tube with a discharge opening above the tip, the entrance to the tube being near the upper end of the fang, with both openings on its front.

In a cross-section of this modified tooth it can be seen that this tube lies in front of the pulp cavity. The fang looks as though an ordinary snake tooth had been flattened out, dentine walls, pulp cavity and all, and then the edges had been brought together to form a tube. The outer walls of the flattened tooth would thus form the inside lining of the tube. It is possible to see the “weld” or the line where the edges of the tube meet at the front on a cobra fang.

While the tube, or venom canal, is indeed lined with dentine, the same substance that forms

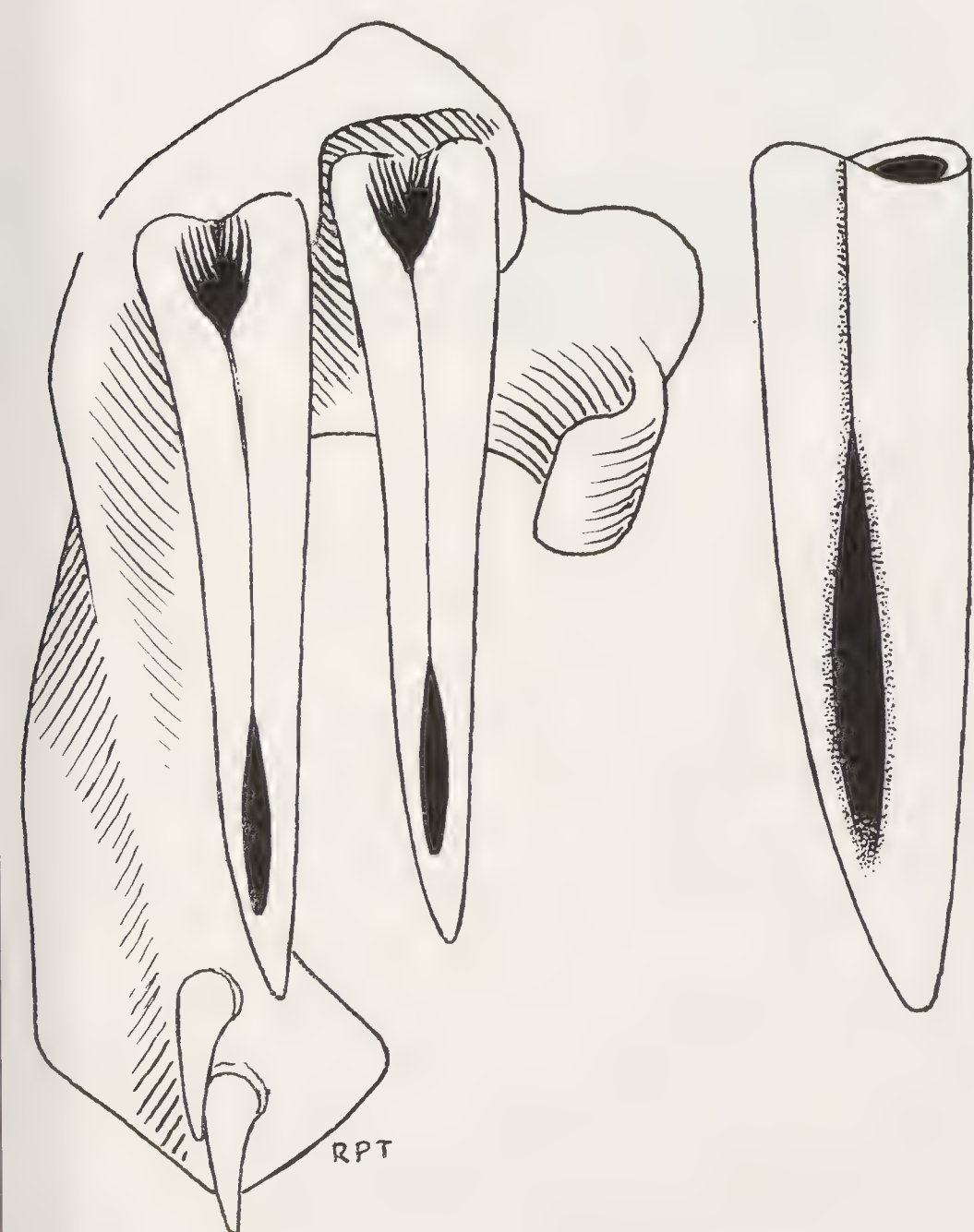
cells that produce the venom. From the front end of the gland there is a duct that leads forward along the side of the head to an opening in the fold of gum tissue that extends down over the front of the fang. Here the discharge end of the duct is held in place at the upper end of the tube or venom canal in the fang. When the muscles surrounding the gland are contracted, they force out the venom. The duct carries it to the upper end of the fang and it is forcibly expelled at the opening near the tip.

In ordinary cobras the venom is ejected in the same plane as the pointed tip. If this were true of the fangs of spitters it would be difficult to account for the forward expulsion of the venom by spitters. One observer attempted to explain the direction of the discharge by asserting that the venom was ejected through the nostrils. Others assumed that it must be carried forward by the air forcibly expelled from the lungs. More precise descriptions, such as that of the late Dr. Raymond L. Ditmars, note that the jaws are slightly parted, but only for an instant as the poison leaves the fangs in twin jets. Some distance away each stream of venom doubtless breaks up into droplets, producing a fine spray. It might almost be compared to firing both barrels of a double-barreled shotgun. To the victim it may seem more like a flame thrower.

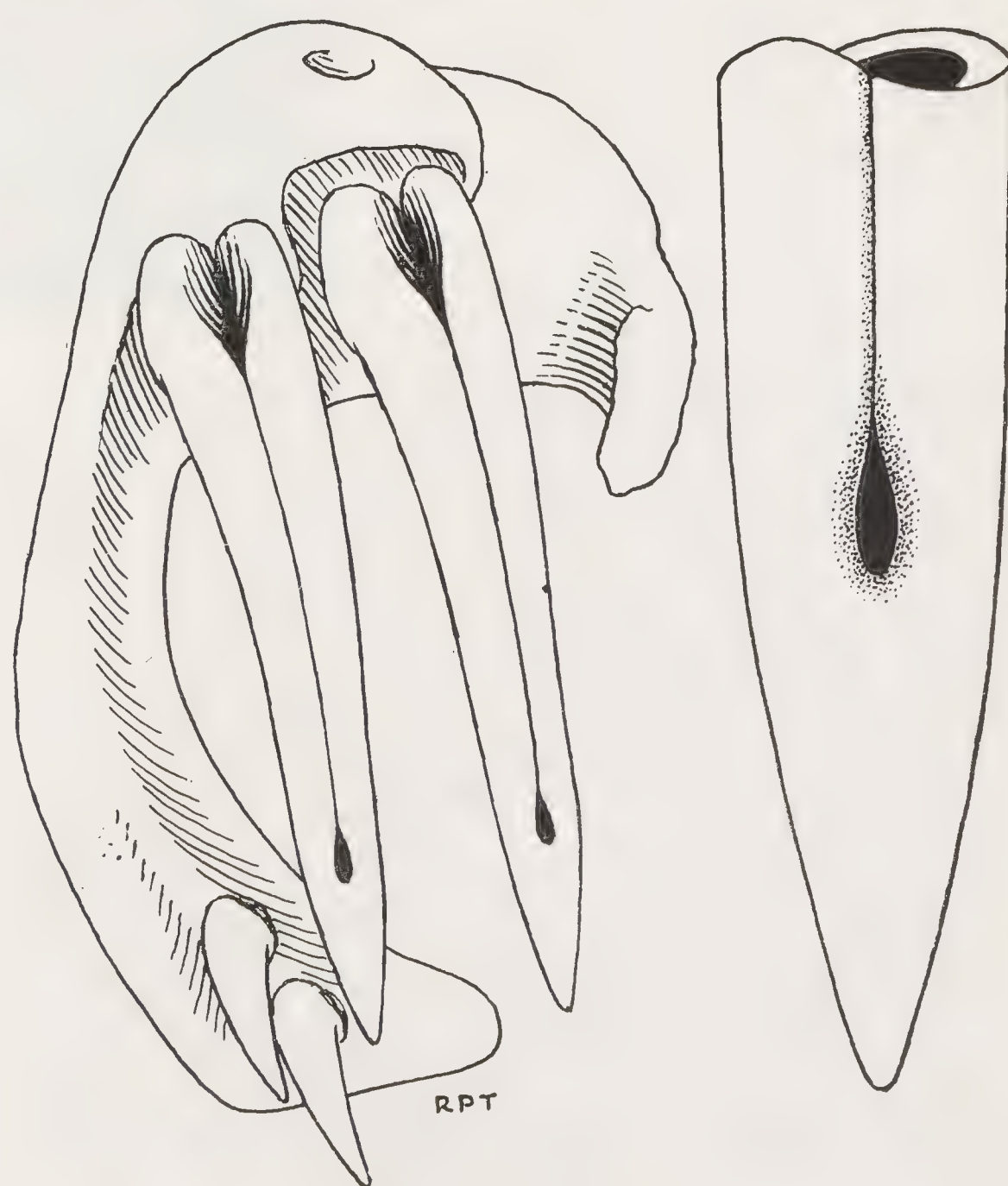
While I was studying a collection of African snakes I became interested in the problem presented by the spitters. Examination of the fangs of a Ringhals disclosed a peculiar modification of the fang. Instead of having a discharge opening trailing off into a groove near the pointed tip of the fang, there was a round opening farther back from the point.

I compared the Ringhals' fang with the fangs of the Yellow Cobra, the Egyptian Cobra, and the Forest Cobra. All of these African cobras proved to have ordinary fangs, with slit-like openings off to one side of the pointed tip. But when I looked at the species that had most often been called a spitter, the Black-necked Cobra (*Naja nigricollis*) of central Africa, its fang was much like that of the Ringhals. I applied a razor blade to the suture or weld down the front of several fangs and managed to split them. As I had expected, in those of spitters the tube or venom canal had an elbow just inside the discharge opening. It looked as though the venom would certainly be

Differences in the fang structure of spitting and non-spitting cobras are clearly shown in these drawings. The discharge opening in the fang of the non-spitter trails off very much as in a hypodermic needle. In the spitter it is rounded and is further back from the point.



"NON-SPITTER"



"SPITTER"

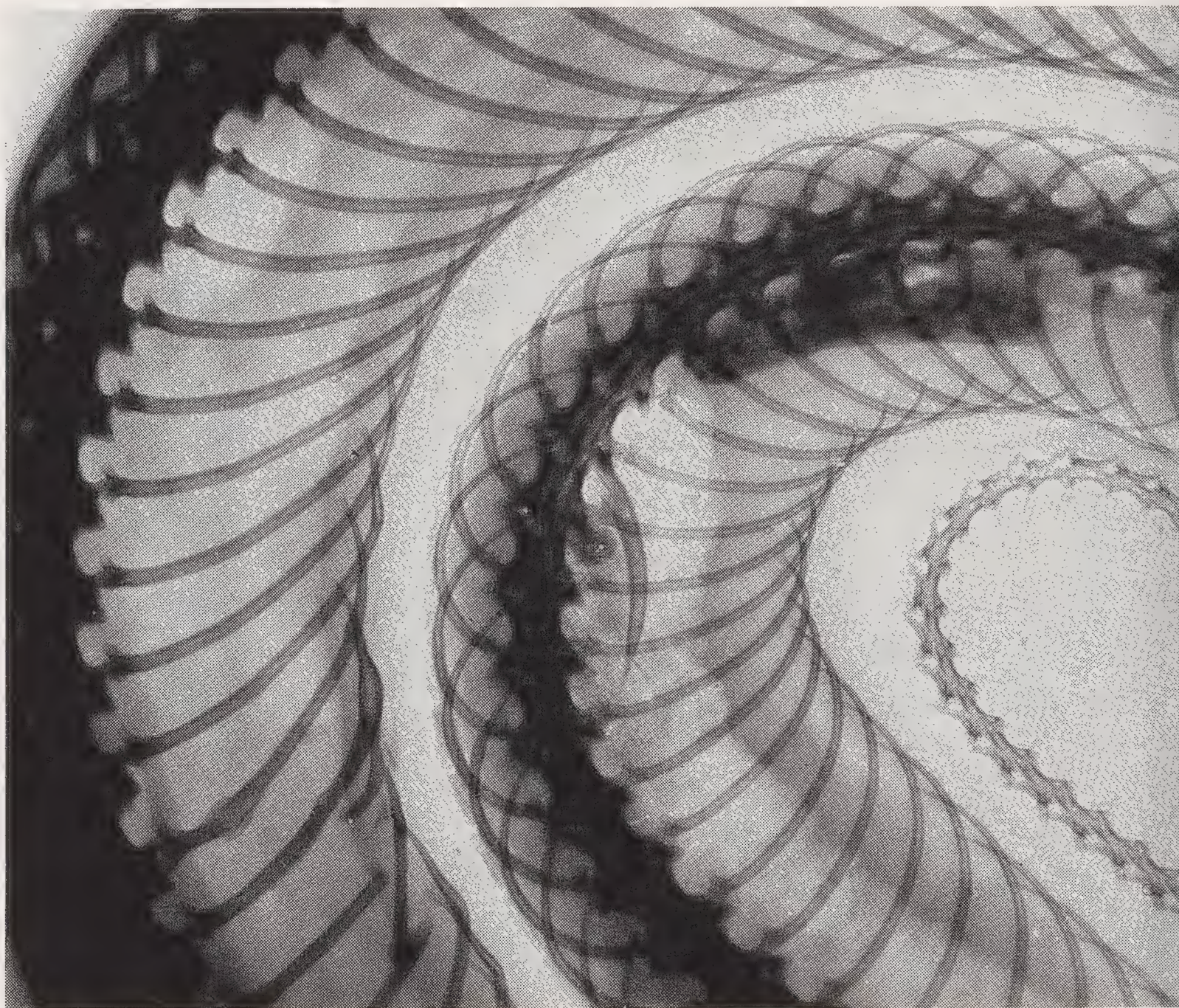
directed outward or perpendicular to the point of the fang. When I removed some more fangs from spitters and forced water through the venom canal I found that it emerged at a right angle to the direction of the fang tip. And when I examined the fangs of the Asiatic spitter I found precisely the same sort of fang.

The explanation was simple enough. These spitters have evolved a special fang that forces the venom outward as Ditmars described it, in one jet from each fang. Obviously it is a dual purpose fang. While it serves to inject venom into prey that must be subdued before it can be engulfed,

evolved any comparable "squirt gun" mechanism? I believe there is an answer to that question, too.

The venoms of cobras are readily absorbed through the thin tissue around the eyes of most mammals. Dogs and probably similar animals that encounter Spitting Cobras in Africa are often permanently blinded by the destructive effects of the venom on the tissues of the eyes. Smaller animals may die. A drop of cobra venom in the eye of a small rodent is absorbed in sufficient quantities to cause the animal's death. In contrast the venom of vipers is not so readily absorbed through the thin membranes. Venoms of

The shed fangs of a venomous snake may be swallowed or, sometimes, left imbedded in the prey and swallowed along with it. This X-ray photograph of a Fer-de-lance indicates that a fang thus ingested is not acted upon by digestion.



the same venom apparatus can also be employed as an effective defense weapon. Obviously a snake is better off if it can discourage an enemy before it approaches close enough to attack. The Spitting Cobra is well equipped to do precisely what is required on this score — and to leave the victim helplessly blinded in the bargain.

Indeed, the ejection of venom aimed at the eyes of an enemy is apparently such an efficient protective device that it has evolved, quite independently, in three distinctly different but related snakes. Why, one may well ask, have the vipers with their relatively enormous fangs — up to two inches long in a six-foot Gaboon Viper — never

rattlesnakes and the African Puff Adder produce no ill effects on the eyes of rats. Such snakes must bite to inject their venom before it can reach the blood stream. Even though vipers were equipped with the specialized fangs required to squirt the venom far enough forward and it were aimed with precision, the venom could not penetrate the more delicate membranes that it might reach.

So zoo keepers can approach the vipers without any fear of being sprayed with venom. But they dare not even peek into the back of the cage housing the Ringhals without making suitable preparations. "Dr. Oliver, where's that welder's mask?"

How We Learn About

COLOR VISION IN ANIMALS

By JOHN V. QUARANTA

Research Associate in Animal Behavior

COLOR is not a modern "discovery" of the advertising agencies and the psychologists, even though the sales appeal of bright colors and the therapeutic effects of certain sections of the spectrum have been extremely well publicized in recent years. People knew about colors a long time ago; in fact, archaeologists would probably agree that the palaces and temples of ancient civilizations were downright gaudy.

Color we human beings have always had with us, except those unfortunate few of us who are congenitally "color blind" and to whom the world appears (in the extreme form of the deficiency) in varying shades of gray. So it is not surprising that over the years and in many lands, scientists have wondered about the color vision of the other animals that share the world with us. What do these animals see — color, like ourselves? And if so, what colors?

It hasn't been easy to find out. Some of the early investigators must have thought it was, however, for they got "results" by such ludicrously simple methods as dyeing a piece of meat blue and seeing whether a dog would recognize it as meat. Of course he did — by smell, if by no other way. Controlled and more elaborate experiments began in the latter part of the Nineteenth Century and are continuing today, so that gradually a technique of investigation has been developed and a substantial body of facts acquired. The total number of animals about whose color vision, or lack of it, we can speak with definiteness is still a mere handful, and unfortunately we cannot safely generalize from them. We cannot, for example, conclude that because the Jumping Spider can discriminate yellow and possibly red, a Garden Spider can do the same. Where they live, how they live, the minute necessities of their daily lives, are likely to be cor-

related with different color vision capacities, for it is generally true that there is a rough correspondence between color vision and an animal's ecological setting. Thus, animals whose eye structure is such that they are capable of distinguishing colors are apt to be found in places with sunshine, light, bright vegetation and strong reflecting surfaces. For dimly illuminated environments, the opposite is true. Wall, the author of the monumental book "The Vertebrate Eye," comments that the eyes of deep-sea fishes are probably the most sensitive in existence — as they would certainly need to be, considering that the depths of the ocean are the nearest approach to perpetual darkness on this globe. The eye structure of deep-sea fishes (predominantly rod, which is the cell structure for black-and-white discrimination) makes it certain that they do not see colors as such, even though (to our eyes) there is an astonishing brilliance of color in some of the deep-sea creatures that have been brought up and studied. Presumably the eyes of deep-sea fishes are stimulated solely by the bioluminescence ("cold light") of so many of the organisms.

In between bright environments and dark ones, between the brilliant tropics and the black depths of the sea, are the zones of temperate brightness, without extremes; here are most likely to be living creatures able to see both color and shades of black-and-white.

If it is almost a necessity to run color vision tests individually on the 20,000 or so species of spiders in order to determine spider color vision exhaustively (literally!), the task is not quite so formidable in regard to some other groups of animals. Mammals, by and large, are more generalized in their environments, more likely to have developed similar capacities because their needs are more alike. Thus one *might* (although always with hesitation), hazard a surmise that be-

cause a Chimpanzee can discriminate red, yellow, green, blue and violet, an Orang-utan can do likewise. Such an informed guess would, as it happens, be correct, for experimental work has been done on both animals and they have been found to have about the same capacities.

Now, how does the laboratory man, the animal behaviorist, go about determining what an animal can or can't see?

Here is how Karl von Frisch of the University of Munich went about his investigation of the color vision of bees, as reported in his monograph, "Bees: Their Vision, Chemical Senses, and Language":

"On our table we place a blue card and around it we arrange gray cards of all shades from white to black. On each card we set a little watch glass, but only the glass dish on the blue card contains food (sugar-water). In this way we train the bees to come to the color blue. Since bees have a very good memory for places we frequently change the relative positions of the cards. But the sugar is always placed on the blue card so that in every case the color indicates where food is to be found. After some hours we perform the decisive experiment. The cards and the glass dishes soiled by the bees are taken away. We place on the table a new series of clean cards of different shades of gray, each with an empty glass dish, and somewhere among them we place a clean, blue card provided, like all the others, with an empty glass dish. The bees remember the blue color and alight only on the blue card, dis-

tinguishing it from all shades of gray. This means that they have a true color sense.

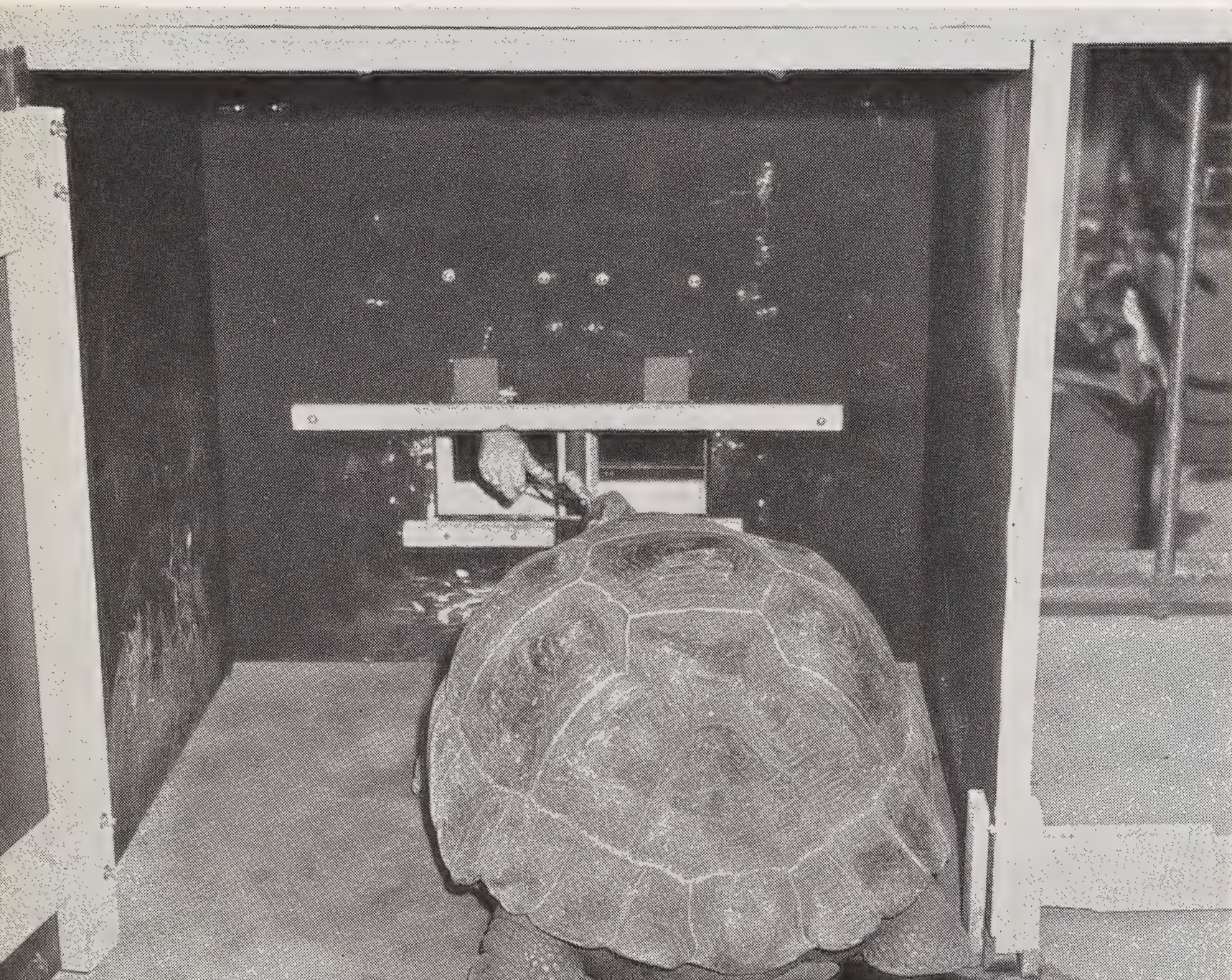
"Training bees to come to food on orange, yellow, green, violet or purple cardboard gives the same positive result. However, if we try to train bees to find their food on scarlet red, they alight not only on the red cardboard but also on the black and on all the dark-gray cards in our arrangement. Thus red and black are the same to the eye of the bee; in other words, bees are red-blind."

Essentially the same sort of procedure is followed when vertebrate animals are tested for color vision. The method is more or less standardized and has been employed by many animal behaviorists. Its application to our own testing of the Galapagos Tortoises in the New York Zoological Park may be cited as an example.

The Galapagos Tortoise is confined in a darkened room with two peep-holes through which beams of colored light can be projected — red through one, green through the other.

When the Tortoise shows a response to the red light, it is rewarded with a banana skin. No reward is given when it stretches toward the green light, and eventually it is conditioned to recognize that red means a banana skin. The lights are, of course, systematically switched from side to side so that mere choice by position is ruled out.

But is the tortoise really choosing between colors, or does one appear, perhaps, brighter or lighter than the other? That can be determined by holding the red light at a constant level of



This is a tortoise-eye-view of the apparatus by which a test was made of the color vision of this reptile. Here the observer is giving the tortoise a reward of food for its correct color choice.

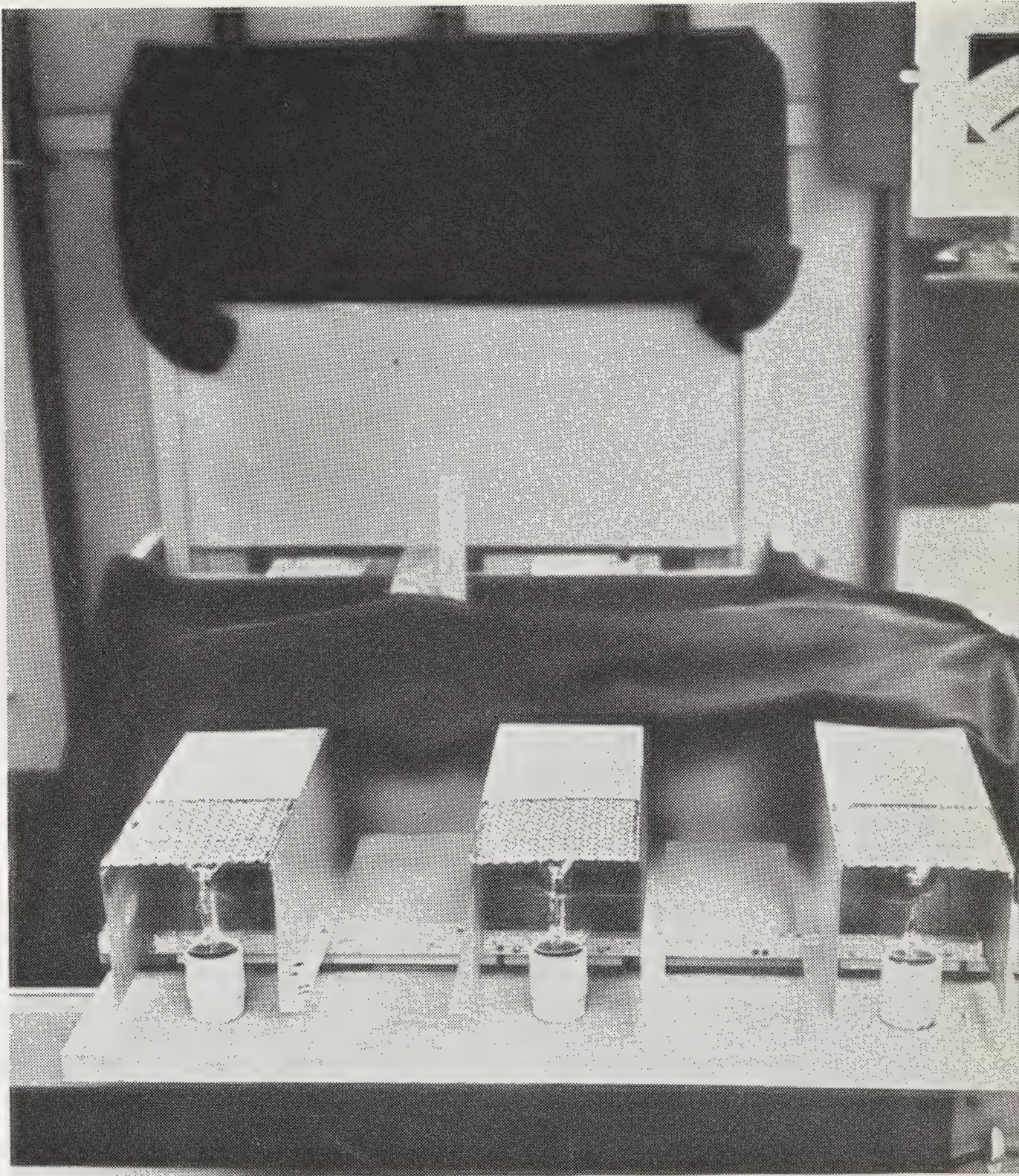
Standing in front of the apparatus, the experimenter can vary by minute degrees the colors to which the tortoise may respond.

brightness and then varying the green light's brightness, in minute steps from very dark green to very light, bright green.

Subsequently the experiment calls for holding the green light at a constant level, and varying the red light through a wide range of brightness.

If the tortoise is not confused by the varying brightnesses of the red-reward-color and the green-no-reward-color, and consistently chooses the red, it is pretty conclusive evidence that it has color vision that includes red — always provided, of course, that the experimental procedure in general has been properly carried out.

Scattered through the technical literature are reports of many such experiments and a number of them have been summarized in the table below. Under "Kind of Eye," retina structure is listed. Cones are important in color vision; rods in black-and-white vision.



<i>Animal</i>	<i>Kind of Eye</i>	<i>Able to Discriminate Between:</i>	<i>Has Maximum Sensitivity to:</i>
CRAB	Compound	Blue, Yellow; possibly Red, Green	No data
CRAYFISH	Compound	No data*	(Blue-Violet)†
WATER FLEA	Compound	Blue, Yellow, Green	(Blue-Green)† or (Green-Yellow)†
JUMPING SPIDER	Compound	Yellow, possibly Red	No data
KING "CRAB" (<i>Limulus</i>)	Compound	No data*	(Blue-Green)†
BEE	Compound	(Orange-Yellow Green),† (Blue-Green),† (Blue-Violet),† (Ultraviolet)†	Ultraviolet, Green
FRUIT FLY	Compound	Green, Blue, Violet, (Blue-Violet)†	Ultraviolet
COCKROACH	Compound	Blue, Green, Yellow	
WALKING STICK	Compound	No data*	(Green-Yellow),† Blue
BITTERLING	All-cone retina	Red, Yellow, Green, Blue, Violet, Ultraviolet	Blue, Orange
STICKLEBACK	All-cone retina	Red, Yellow, Green, Blue, Violet, Ultraviolet	Blue end of spectrum
BLUEGILL SUNFISH	All-cone retina	Red, Green	Red end of spectrum
GIANT GALAPAGOS	All-cone	Red, Green, Blue	Orange-Red

* An animal may give no behavioral evidence of color vision, and still show maximum sensitivity to a particular portion of the spectrum.
† Seen as one color.

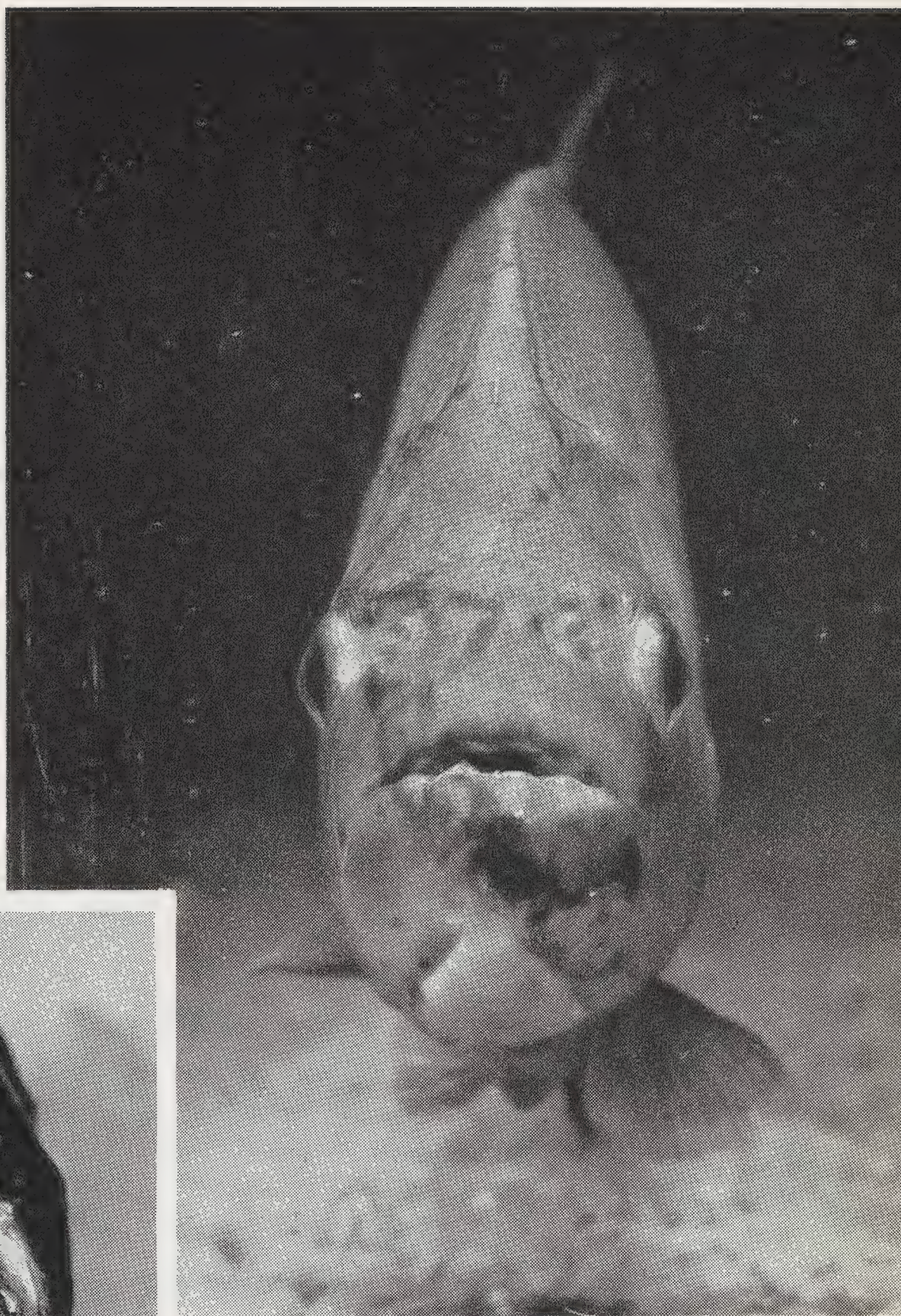
<i>Animal</i>	<i>Kind of Eye</i>	<i>Able to Discriminate Between:</i>	<i>Has Maximum Sensitivity to:</i>
TORTOISE	retina		
GARTER SNAKE	All-cone retina	Possibly Red, Blue	Orange-Red
ALLIGATOR	Rod-Cone retina	Has color vision; no other data	In dim light: Green In bright light: Yellow-Green
SAND LIZARD	Predominantly Cone retina	Red, Orange, Yellow, Green, Blue, Violet	Red
FLORIDA CRICKET FROG	Rod-Cone retina	Red, Green, Blue	Green
EUROPEAN COMMON FROG	Rod-Cone retina	Red, Blue	No data
CHICKEN	Predominantly Cone retina	Red, Yellow, Green, Blue-Green	Yellow-Green
PIGEON	Predominantly Cone retina	Red, Yellow, Green, Blue, Violet	Yellow-Green
OWL	Predominantly Rod retina	No color vision	
BAT	Predominantly Rod retina	No color vision	
DOG	Predominantly Rod retina	Possibly Green (all else gray)	No data
GUINEA PIG	Predominantly Rod retina	No color vision	
CAT	Predominantly Rod retina	Apparently no color vision*	Green
RABBIT	Predominantly Rod retina	Red, Green	Yellow
RAT	Predominantly Rod retina; some Cones	Red, Blue	No data
CEBUS MONKEY	Rod-Cone retina	Red, Blue	No data
RHESUS MONKEY	Rod-Cone retina	Red, Yellow, Green, Blue, Violet	In dim light: Green-Yellow In bright light: Yellow-Green
CHIMPANZEE	Rod-Cone retina	Red, Yellow, Green, Blue, Violet	In dim light: Green-Yellow In bright light: Yellow-Green
ORANG-UTAN	Rod-Cone retina	Red, Yellow, Green, Blue, Violet	In dim light: Green-Yellow In bright light: Yellow-Green
MAN	Rod-Cone retina	Red, Yellow, Green, Blue, Violet	In dim light: Green-Yellow In bright light: Yellow-Green

* An animal may give no behavioral evidence of color vision, and still show maximum sensitivity to a particular portion of the spectrum.

MOST DANGEROUS TO MAN?

By
JAMES
W.
ATZ

*Assistant Curator,
New York Aquarium*

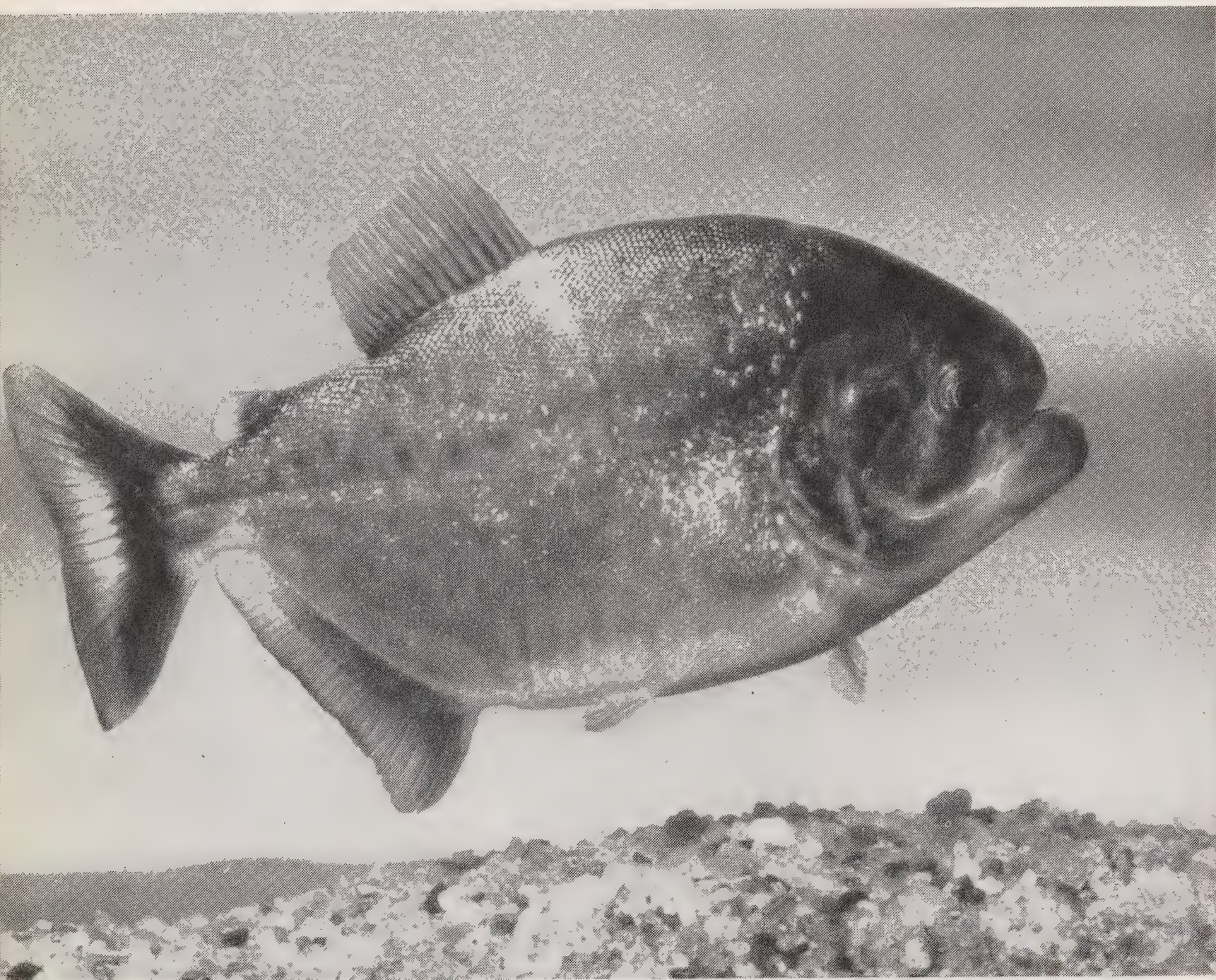


ABOVE—Head-on view of the Black Piranha. **LEFT**—Here a portion of the lips has been cut away to show the stout, sharp teeth by means of which the Piranha has gained its reputation.

A QUESTION we are frequently asked is: What fish is most dangerous to man? As with the majority of such categorical questions, there is no simple answer.

Is the Great White Shark, also called the Man-eater, the most dangerous fish? Without doubt this is the most savage of all the sharks — so far as man is concerned — for it attains a length of more than thirty-six feet and has been known to make unprovoked attacks not only on bathers and divers but on small boats. Nevertheless, undoubtedly other kinds of sharks are responsible for greater numbers of human deaths; for in-

stance, the Whaler Shark of Australia that has contributed more than its share to the two hundred or so deaths from shark attack recorded from around that continent between 1840 and 1940. Or perhaps the Great Barracuda of the West Indies would qualify for the distinction of being "most dangerous to man." Many so-called shark attacks are actually the work of this dreadful flesh-eating fish which can practically amputate a man's arm or leg with one swipe of its tremendous jaws, and has a fearless, aggressive disposition to go with its formidable armature. But relatively few people suffer from shark or bar-



Best-known and most widely distributed of the four really dangerous Piranhas is *Serrasalmus nattereri*. It reaches a length of 10½ inches and enormous schools make concerted attacks.

racuda attacks. If sheer numbers of persons adversely affected by fish are the criterion, the worst piscine villains in man's experience are those species that transmit the Broad Fish Tapeworm to thousands of European and North American consumers of insufficiently-cooked fish or infect even greater numbers of unfortunate Asiatics with the Chinese Liver Fluke. Moreover, no one knows how many people have been fatally poisoned by eating one of the three hundred or more different fishes with toxic flesh that live in the Central Pacific, to say nothing of the lesser numbers of poisonous fishes that inhabit some other waters on the earth.

All of these fishes are dangerous, but no single one of them unqualifiedly rates as *the* most dangerous fish. If we change the original question a little, however, a more definite answer can be given. What single species of fish has actually killed more human beings than any other? The answer to this seems clear. It is the Piranha, *Serrasalmus nattereri*.

Ever since Theodore Roosevelt penetrated South America to explore the "River of Doubt" and made the acquaintance of the savage Cannibal Fish infesting that almost legendary stream, people have been piranha-conscious. It was the ex-President who first made Piranhas a popular

topic of conversation. His gruesome stories of people and animals being literally eaten alive by hordes of small but savage fish could not fail to appeal to the sense of the macabre that exists in all of us.

Whether one secretly enjoys a little blood-thirstiness or not, the Piranha is a remarkable creature. Professor George S. Myers of Stanford University, who is one of our leading students of fishes, has set himself the task of unravelling the truth from the fiction that inevitably has accumulated around this fish. Here is the way he epitomizes the Piranha: "A fish only a foot long with teeth so sharp and jaws so strong that it can chop out a piece of flesh from a man or an alligator as neatly as a razor, or clip off a finger or toe, bone and all, with the dispatch of a meat-cleaver! A fish afraid of nothing, which attacks any animal, whatever its size, like lightning! A fish which never attacks singly but always in schools of a hundred or a thousand! A fish which is actually attracted by splashing and commotion in the water! And a fish which, when it smells blood, turns into a raging demon! This is the piranha, feared as no other animal is feared throughout the whole length of South America."¹

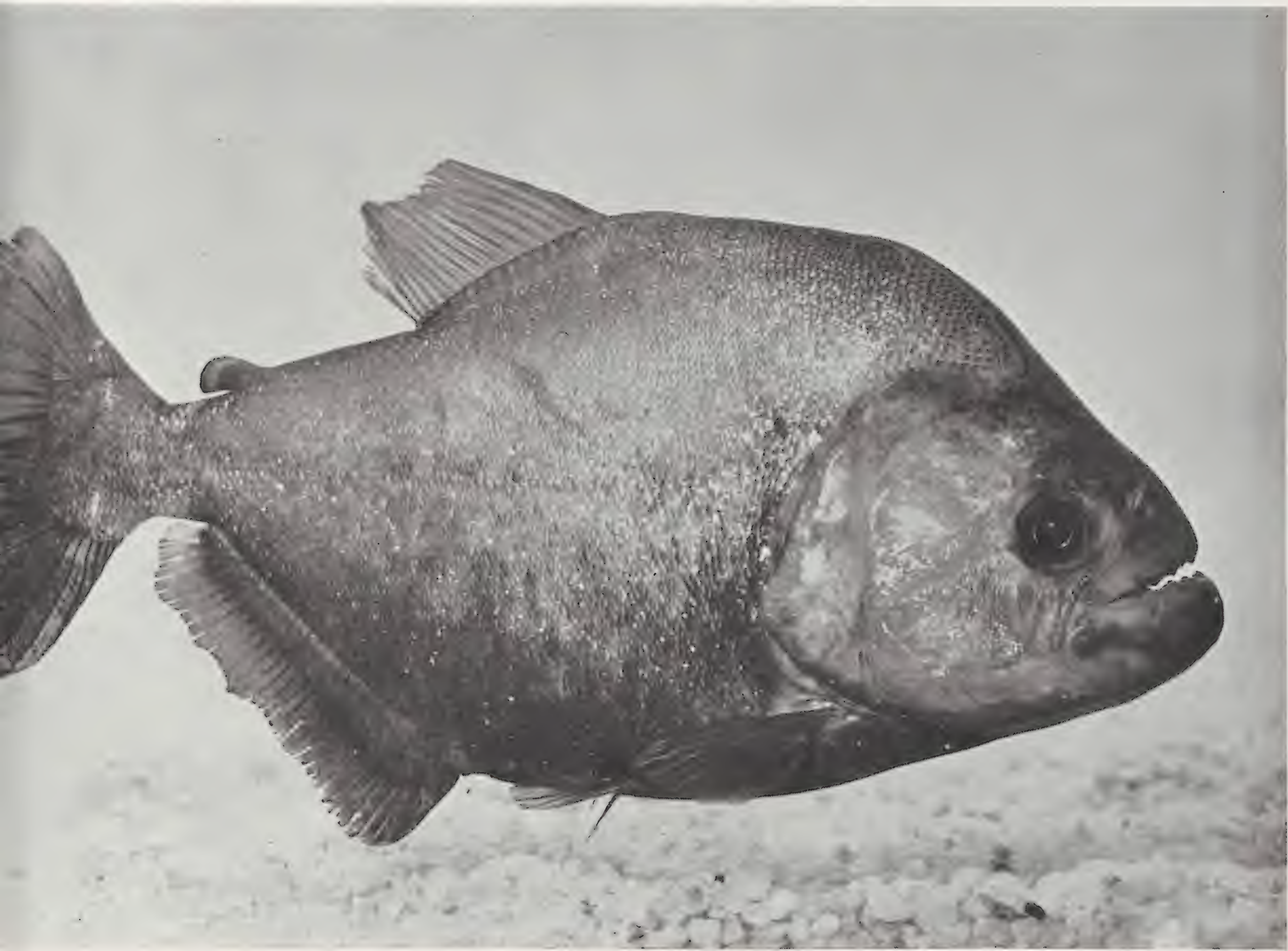
One of the facts Professor Myers has estab-

¹ *Aquarium Journ.*, 20 : 52-61, 76-85, 1949.

lished is that not all of the fishes commonly known as Piranhas are dangerous to human beings. In fact, of the twenty or so closely-related species to which the name has been applied, only four are proved man-eaters. Of these, *Serrasalmus nattereri* is by far the most widespread and the one responsible for most human fatalities. To all intents and purposes, it is *the* Piranha. It occurs through most of northern and eastern South America, from Venezuela and the Guianas all the way to Argentina. Fortunately, not all

for all of the Piranhas and their closest relatives are flesh-eaters, preying on other creatures, principally fishes). Of the four deadly species, we had up to recently exhibited but one, *Serrasalmus nattereri*.

Although this Piranha is native to the same waters as many of the most attractive small tropical fishes suitable for home aquaria, and although professional collectors regularly fish in these places in order to satisfy the continuous demand for pet fishes, few Piranhas ever leave the Ama-



ivers have Piranhas, and the fish is not found at all localities in those streams in which it does occur. Nevertheless, it is prevalent enough to make swimming or wading an extremely risky pastime over about half an entire continent.

Piranhas are generally on exhibit at the Aquarium, if not one of the man-eating species, then one of the harmless types — some of which, strangely enough, look more vicious than do the four truly dangerous ones. (When we say “harmless” we mean only so far as man is concerned,

Dark coloration and a slightly concave forehead are among the features that immediately revealed this 11-inch fish as the Black Piranha, now first exhibited in the United States.

zon or any other South American streams. The reasons for this are not far to seek. In the first place, fish collectors quite naturally hesitate to operate in places where Piranhas abound. Secondly, even if they did want to catch Piranhas, the nets, traps and seines they ordinarily employ

would be quite useless. Piranhas will bite through and ruin any network. They readily take the baited hook, but especially strong hooks and leaders must be used, because good-sized specimens can bite through piano wire. And once a Piranha is caught, what can you do with such a jumping, snapping, animated chopping machine, except perhaps deal it a stunning blow on the head or crush it beneath the heel of your boot? The problem of how to get a hooked Piranha into a shipping can without hurting the fish or losing a finger in the process is almost insoluble. Because they are so savage, Piranhas must be shipped alone, each specimen occupying a sep-

arate shipping can. It therefore costs as much to bring a single Piranha to the United States as it does, say, three hundred Neon Tetras. No wonder few Piranhas reach the live fish market and no wonder they are expensive.

Early last March we received a telephone call from Wilmar Aquarium, a commercial tropical fish firm, asking us whether we were interested in some large "piranhas" that they had just brought in from British Guiana. Piranhas always interest us but the species most frequently imported from Brazil or British Guiana is *Serrasalmus rhombeus*, one of the less savage kind, and we already had two such fish. Nevertheless, because the fish offered were nearly a foot long,



One of the less savage Piranhas is *Serrasalmus rhombeus*, which is almost 15 inches long. It is known as "Pirambeba" in Brazil.

and on the off chance that they might turn out to be one of the man-eating species, we ordered one. When the specimen was delivered and was dumped into a tank — for dumping a Piranha is much safer and less hard on equipment than is the gentler method of transferring it by means of a net — we received one of those surprises that zoo and aquarium curators are constantly hoping for.

Here was a fish that neither Curator Coates nor I had ever seen before. A Piranha it definitely was, but instead of the silvery color exhibited by most Piranhas, it was a gun-metal gray. Excitedly I hastened back to the office to get a copy of Professor Myers' "Monograph on the Piranha." Could it be that here was the mysterious Black Piranha? A hasty comparison of critical points confirmed our hopes. The slightly concave forehead — not so decurved as in *S. rhombeus* but more than in *S. nattereri*; the dark color; the somewhat larger lower lobe of the tail fin; and a few estimated relative measurements all indicated that this indeed was a Black Piranha.

The Black Piranha, *Serrasalmus niger*, has been known to science for more than one hundred years. The indefatigable German explorer-botanist, Richard Schomburgk, collected at least one specimen during his extensive travels in British Guiana, and he soon described it in his

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book on the fishes of that country, which was published in 1841. In all the years since then, not another specimen has been catalogued in the museums of the world. When J. R. Norman, the eminent British ichthyologist, reviewed the Subfamily Serrasalmoninae, to which the Piranhas belong, he was forced to conclude that maybe *Serrasalmus niger* wasn't a "good" species after all. Perhaps Schomburgk had just happened to pick up an abnormal individual of the well-recognized species *S. nattereri*. Professor Carl Eigenmann of the University of Indiana looked for Black Piranhas on his 1908 expedition to British Guiana. His monograph on British Guiana's fishes is the most complete and authoritative work existing on the subject, but in it Eigenmann had to accept Schomburgk's word that there was such a fish. He had found no specimens himself.

From 1916 to 1924 the New York Zoological Society maintained a Tropical Research Station in British Guiana. There, at Kalacoon and Kartabo, the Peraí or Carib Fish, as Piranhas are called by the colonials, was well known. G. Innes Hartley, Research Assistant at the station, recorded what little he could find out about the natural history of the creature, and his associate, Paul G. Howes, took an excellent photograph of a fish that is unmistakably a Black Piranha. Unfortunately, Hartley, in common with other observers of British Guiana's fishes,² did not make clear whether the rather horrible accounts he gave of Piranha ferocity all refer to the work of the Black Piranha, or whether the other local species, *S. nattereri*, was partly responsible. The latter is probably more widespread, even in British Guiana, than is the Black one.

Hartley describes how "Hours sometimes pass without a movement in the water and then suddenly there is a splash, and you know that the perai are at work. If you toss a small lizard into the pool or a wounded bird drops into it, even though the water be as quiet and as innocent-looking as the sky above, you may be sure that one or more of the hungry pirates are lurking in its dark depths, ready to pounce upon whatever comes; and you may be sure that the poor victim will never reach the bank toward which it so vainly struggles. Suddenly the wild flutters stop, only to recommence with increased frenzy. There

is a disturbance about with ripples running to the shore; the swimming creature strives vainly against some agency that pulls it down; then it disappears and the waters are quiet once more; only a few bubbles float on the surface."³ But fish, not birds or reptiles, are the Piranhas' chief food, as Hartley points out, and not only do they "war upon other fish, but also upon their own kind. This has been a rather disputed question. Some authorities claim that they will never attack one another; but many perai have the webbing nearly gone from their tails and are otherwise scarred about the body. I have caught many on the flesh and entrails of another. . . . If one, freshly killed, be gashed and torn so that the blood flows, it will be set upon and devoured as quickly as if it were a warm-blooded bird. If only wounded, however, its sharp teeth and strong jaws protect it until recovery or, worn out by the repeated sallies of others, until it succumbs." Truly a Cannibal Fish.

There is little question in our minds about the savagery of the Black Piranha. The way our fish goes after the raw meat or fish that we feed it leaves scarcely any room for doubt, as does its behavior while on exhibition, where it frequently fixes visitors with its baleful red eyes and shows a more than passing interest in the fingers that are invariably poked at it.

From Wilmar Aquarium we have purchased three more Black Piranhas, and one specimen has been sent to Dr. Myers for the collections of the Natural History Museum at Stanford University. It is doubtful whether Schomburgk's original fish, the type specimen, still exists, since it belonged to the hapless Berlin Museum which was almost completely destroyed during the war. Our specimens and the two preserved ones in the collection of the Department of Tropical Research thus take on added scientific significance.

The new Black Piranhas have more than lived up to expectations. But with collector's spirit, we are not yet satisfied. There is another species of Piranha, found only in the Rio Sao Francisco in eastern Brazil, that is the largest and supposedly the most dangerous of all these fishes. Imagine a Piranha two feet long! This is the species we are now hoping to obtain for exhibition some day in the not too distant future.

² For example, Vincent Roth in his book "Fish Life in British Guiana," *The Daily Chronicle*, Georgetown, 1943.

³ "Tropical Wild Life in British Guiana," N. Y. Zoological Society, 1917.

THE WEANING OF "FLIP"

CALIFORNIA SEALION pups are always welcome additions to our collection, but we much prefer to have them reared by their own mothers rather than by human foster-parents, for the pups do not take kindly to weaning and it is a tedious business to get them accustomed to taking fish either from a pan or from the water in their pool. The pup in these photographs was born on May 4 of last year and was doing well until its mother died this spring. Thereupon the baby had to be removed from the Sealion Pool and hand-reared in the Animal Hospital, where it soon made itself at home as an inquisitive pet.



"Flip" had a daily routine that involved going into every room in the Hospital each morning. His visits seldom lasted longer than a minute.



Hospital Attendant Coder was special friend, for he presided over food in the Diet Kitchen.

PHOTOGRAPHS BY

SAM DUNTON

STAFF PHOTOGRAPHER



One leap carried him onto a shelf almost four feet from the floor, to sniff at the food box.

The baby liked fish well enough, but at first he would take them only when offered by hand.



p" had an enormous amount of curiosity almost anything within his sight or reach investigated with surprising gentleness.





But the day came when "Flip" was sufficiently familiar with fish in all its forms—both in a pan and in the water—to be able to feed himself, and then he was returned to the big Pool.

And his readoption into the Sealion herd was automatic and complete. We still have to entice the other animals away before throwing fish to "Flip," but he manages to get plenty to eat.



No Longer a Mystery—

The Range of Father David's Deer

By ARTHUR DE C. SOWERBY

Former Director, Shanghai Museum (R.A.S.)

PERHAPS THE STRANGEST of all living deer is that known popularly as Father David's deer, or scientifically as *Elaphurus davidianus* (Milne-Edwards). Not only is this large deer strange in its habits and appearance, in comparison with other known deer, but its relationship with man is unique. Instead of having been exterminated by man, as has been the sad case with all too many of the larger quadrupeds, it has actually been preserved from that fate by man.

The remarkable feature about its being thus protected is that, as far as is known, it has never been domesticated.

Nor has it ever been observed in a wild state; that is, since its first discovery by Father Armand David as he looked over the high enclosing wall of the famous hunting park south of Peking called the Nan Hai-tzu, or Southern Lake, in 1865. Even at that time it did not exist anywhere outside the wall of that great park.

For this reason the original habitat and distribution of Father David's deer has up till quite recently been a mystery, in spite of the fact that trained zoological collectors of Europe and America have explored more or less thoroughly every part of Eastern and Southeastern Asia, where this deer might have been found.

In this connection considerable confusion has resulted from the fact that the popular name for the David's deer in Chinese, *Ssu-pu-hsiang*, meaning the "four dissimilarities," is used also for the reindeer. This accounts for frequent reports, prevalent till but a few years ago, that deer of this species occurred in such places as Chinese Turkestan, Western Mongolia and Eastern Siberia, in all three of which areas reindeer

are to be found, either in a wild state or under domestication.

There is, however, evidence in the way of fossil or subfossil remains of David's deer to show



that even as late as historical times deer of this species occurred in considerable numbers over a wide range of territory in Eastern Asia embracing the great low-lying flat lands formed by the mighty Yellow River and other lesser rivers of Eastern China, from east of Peking in the north to the neighbourhood of Hangchow on the Ch'ien-t'ang River estuary in the south, and from Lo-yang in Honan Province in the west to as far as Japan in the east, Japan having been joined to the Asiatic land-mass in no very distant times past.

The first attempt to ascertain the original natural habitat and distribution of Father David's deer was made by O. F. von Mollendorff in his learned paper read before the North China Branch of the Royal Asiatic Society in Shanghai, in 1877, entitled "The Vertebrata of the Province of Chihli, with Notes on Chinese Zoological Nomenclature," published in the Society's Journal of that year. It was his idea that David's deer was originally indigenous to the plains of Northern and Central China, and that it had gradually been exterminated by the progress of cultivation.

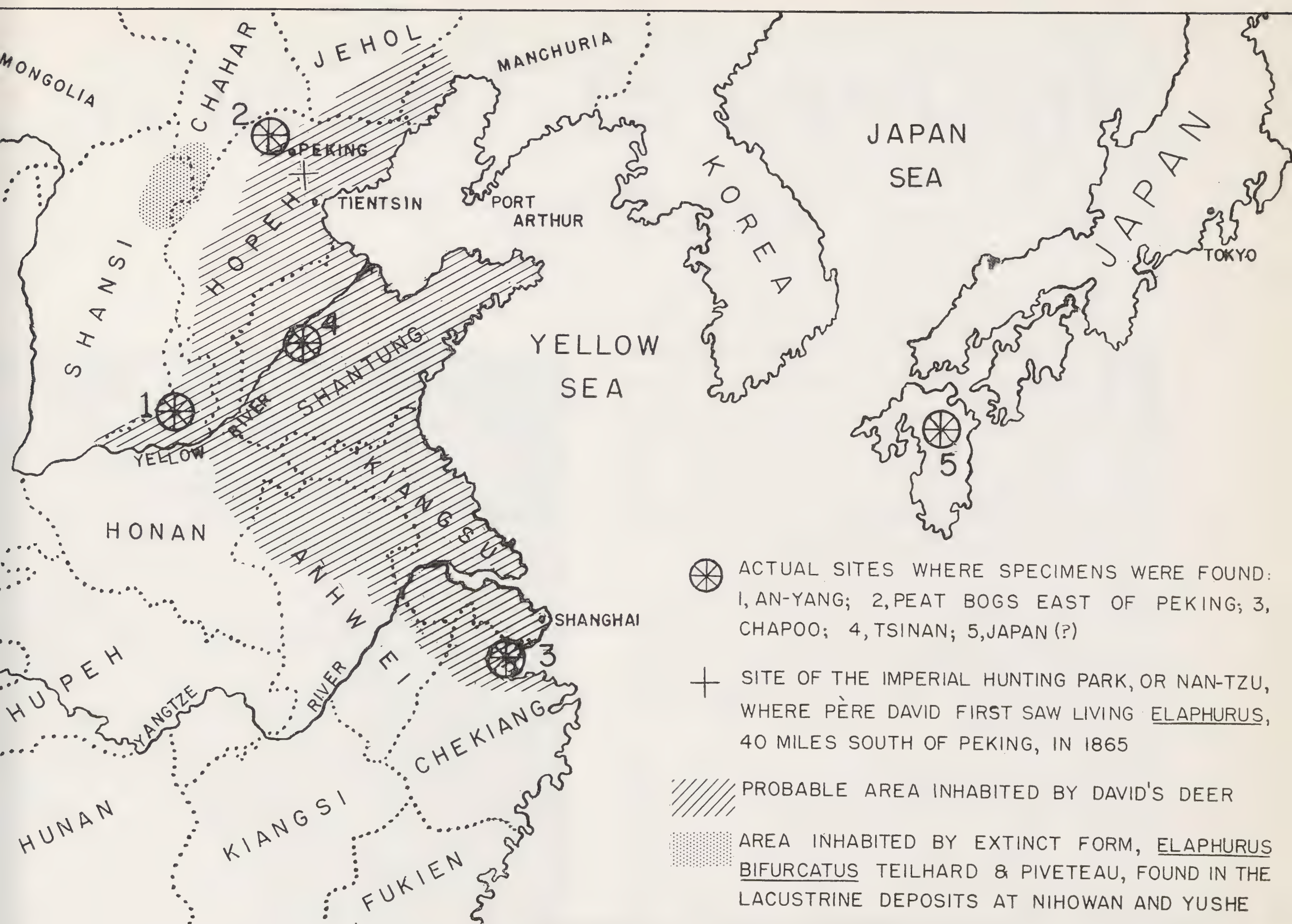
It was not till 1924 that anything in the way

of concrete evidence came to light that this large deer had indeed been an inhabitant of the great plains of Eastern China. At that time the Reverend James M. Menzies of Honan brought to the Shanghai Museum (R.A.S.), of which I was in charge, a collection of relics that he had excavated at An-yang, the site of the ancient capital of the Shang Dynasty (1776-1122 B.C.). Amongst these were a number of fragments of deer antlers, which turned out to be those of David's deer. Mr. Menzies informed me that there were many piles of antler fragments similar to those he had brought to the Museum.

I was sure that at least one of the antler fragments was from a David's deer, but the other fragments puzzled me sufficiently to cause me to base a new species of deer upon them in a paper I wrote and published in "The China Journal" in September, 1933, naming it *Cervus (Rucervus) menziesianus* after Mr. Menzies. Later I realized that I had made a mistake in that all the pieces of deer antler belonged to David's deer, except one piece, which belonged to a roedeer (*Capreolus*). These antler fragments were all associated with various stone and bone artifacts



Fragmentary sub-fossil remains of the antlers of the David's deer, excavated at An-yang, ancient capital of the Shang Dynasty, 1776 to 1122 B.C. (Author's photo).



⊗ ACTUAL SITES WHERE SPECIMENS WERE FOUND: 1, AN-YANG; 2, PEAT BOGS EAST OF PEKING; 3, CHAPOO; 4, TSINAN; 5, JAPAN (?)

⊕ SITE OF THE IMPERIAL HUNTING PARK, OR NAN-TZU, WHERE PÈRE DAVID FIRST SAW LIVING *ELAPHURUS*, 40 MILES SOUTH OF PEKING, IN 1865

/// PROBABLE AREA INHABITED BY DAVID'S DEER

⋯ AREA INHABITED BY EXTINCT FORM, *ELAPHURUS BIFURCATUS* TEILHARD & PIVETEAU, FOUND IN THE LACUSTRINE DEPOSITS AT NIHOWAN AND YUSHE

and baked clay vessels, also the remains of other animals, including elephant and water buffalo.

Since that time further excavations at An-yang have yielded many more relics of David's deer in the way of bones and antlers.

Still later excavations in ancient peat bogs east of Peking in Hopei (formerly Chihli) Province, yielded complete antlers of David's deer in a semi-fossilized condition, and in association with human artifacts. In Japan the discovery of relics of David's deer have been reported in a number of scientific journals.

The latest discovery of remains of David's deer was made by Mr. Igor S. Pakidoff of Shanghai in the Chapoo area about 90 miles south of the city near Hangchow on the Ch'ien-t'ang Estuary in Northeastern Chekiang Province. These consisted of several sections of antlers which Mr. Pakidoff found in the mud at low tide while bathing. One piece was picked up in a ploughed field some distance inland from the

Map showing the probable area of distribution of Père David's Deer, based upon the discoveries made in recent years of bones and antlers. The animal is now extinct in China.

shore. He brought these specimens to me in Shanghai just two days before I left China for South Africa on August 19th, 1948. This discovery extends the known original range of this deer several hundred miles further south than had been established up to that time. Altogether Mr. Pakidoff gave me six pieces of antler representing two horns, most probably from two different stags. Later I received a letter from him, in which he informed me that he found many fossil bones and several pieces of antlers in the same area of Chapoo, but I have no knowledge as to what was done with these.

The specimens he gave to me I brought to Washington, where I donated them to the United States National Museum.

HELPERS AT THE NEST

By ALEXANDER F. SKUTCH

San Isidor del General, Costa Rica

BETWEEN MY HOUSE in Costa Rica and the broad mountain stream that it faces lies a rocky pasture, shaded by orange, guava and other trees, in whose leafy crowns many birds build. Last May I found, high in a spreading copalchí tree in this pasture, a most puzzling nest. Three birds were bringing food to it! These were a pair of Golden-masked Tanagers, elegantly attired in blue, black, yellow and white, and a female White-browed Gnatcatcher, a smaller and plainer bird, whose sharp, slender bill contrasted with the short, thick bills of the tanagers.

Here was a mystery to be solved! How had this unusual situation come about? Who had built the nest, and whose were the nestlings it held? A close examination might have answered some of these questions, but the structure was too high to be reached by a ladder and too far out from the trunk to be approached by climbing. The best I could do was to watch from the ground. The size of the nest suggested that it had been built by the tanagers, and the outer covering of moss pointed to the same conclusion. The neater, downier cup of a pair of gnatcatchers would have been plastered over with bits of lichen and liverworts rather than thickly covered with green moss. When the occupants stretched up their necks to receive food, I never saw more than two heads, and the interior of their mouths was red, as in tanagers, rather than yellow, as with gnatcatchers. All of these facts led me to believe that the nest belonged to the Golden-masked Tanagers and the female gnatcatcher was an intruder. The failure of the male gnatcatcher, who sang blithely in the distance, to take any interest in it, strengthened this belief, for normally the male gnatcatcher is a faithful attendant of eggs and young.

The parent tanagers usually came to their nest



together, each bringing a billful of berries or fruit pulp. Then, after each in turn had delivered its contribution, they winged away in company, often voicing the rapid series of dry, ticking notes which is their only song. As the nestlings grew older their visits became very frequent, and the two together gave the youngsters from 17 to 22 billfuls in an hour. In contrast to the bulky portions brought by the parents, the female gnatcatcher came with tiny insects or other small morsels held daintily in her slender bill. Because she spent so much time flitting around the nest amidst the foliage, which screened her approach to it, I found it difficult to learn how many times she fed the nestlings, but at the beginning of my observations she seemed to do so about as often as either one of the parents. Although the food brought by the gnatcatcher weighed far less than that brought by the parents, it helped to vary the nestlings' diet.

When I first discovered the nestlings they were still unfeathered and required a good deal of brooding. This office was performed not only by their mother but also by the attendant gnatcatcher, who also spent much time resting on the nest's rim with her breast above the little ones.

Although the gnatcatcher was so solicitous of the young tanagers' welfare, it was plain that she was not on friendly terms with their parents. If she happened to be sitting when they flew up together with food, she was careful to hop from the nest before they reached it, never receiving from them a morsel to be passed to the nestlings she brooded, as frequently happens with birds that cooperate more closely in the care of the

young. While the tanagers were at the nest she would flit around it in a belligerent attitude, her tail fanned out to display the white outer feathers that contrasted prettily with the dark central ones, her wings drooping, while she protested with her sharp, nasal *chaaa*. If, after feeding, the mother tanager settled down for a period of brooding, the gnatcatcher would continue to hop around her and complain. Sometimes she would pursue the parents as they flew back and forth between the nest tree and the neighboring woodland where they hunted food. As the days passed and the nestlings seemed to become too big for the little helper to brood them with comfort, she devoted less time to ministering to their needs and more to trying to keep the parents away from them. But most of the time the parents ignored their quarrelsome assistant, chasing her only when she darted close to them, and never pursuing her far.

A few days after I found this nest I discovered that the male gnatcatcher was building one of his own in the same tree, about three yards from that of the tanagers. He brought much cobweb, which with his long, black bill he carefully applied to the lichen-covered outer surface of the little cup. His mate, absorbed in the nestling tanagers, gave him no help and seemed indifferent to his effort to prepare for a family of gnatcatchers. He in turn ignored the neighboring nest which so engrossed her. But if the tanagers and the female gnatcatcher happened to be engaged in a lively chase as he passed by, he might join the commotion, which was of brief duration and never resulted in the loss of a feather.

LEFT—Four nestlings of the Black-eared Bush-tit posed above the lichen-covered nest. Extra males help to feed them. RIGHT—One of the 15-day-old nestlings, hardly large enough to fill a teaspoon. Male babies predominated.

(Photos by the Author)



He built in vain; after the two young tanagers grew feathers and flew away, his nest remained deserted, too. Although the female gnatcatcher attended the tanagers so long as they stayed in the nest, I doubt whether she followed them through the tree-tops with their parents, and she might then have been free to raise a family of her own.

In the same shady pasture I found, some years earlier, another nest of the pretty Golden-masked Tanager with a helper of a different sort. Instead of a bird of a distinct species, this time the assistant was a young Golden-masked Tanager, whose greenish plumage was variegated by the earliest flecks of the richer adult colors. Since the time was late June, this bird was probably an older brother or sister of the nestlings it attended, hatched in an earlier nest of the same season. Its relation to the nestlings' parents was far different from that of the gnatcatcher. In five morning hours the young assistant brought food 19 times, the two parents together 67 times, making 86 feedings for the two nestlings. Eighteen times in this period all three of the attendants arrived together, and 16 of these times the young bird fed the nestlings along with the adults, leaving only three times when it came alone with food. When the trio arrived together, either the helper or a parent might be the first to deliver its billful. In this instance, it was difficult to decide whether a precocious awakening of the parental instinct, or a social bond which led the young tanager to accompany its parents and to imitate them, was responsible for this early manifestation of parental behavior. Probably the youngster was determined by both of these motives to bring food to the nestlings.

At two other nests, one on my farm in Costa Rica and the other in Panamá, I have found young Golden-masked Tanagers in juvenal or transitional plumage helping the parents to attend nestlings. Both of these nests were late ones situated near early nests in which young had been reared, so that it is fairly certain that the helper was in each instance an older brother or sister of the nestlings it attended. The greenish young tanager who fed nestlings in a calabash tree in front of my house in 1946 amused me by its inconstant behavior. When I first discovered it feeding the nestlings, it brought them food, in-

cluding banana from the neighboring bird table, about as often as either one of the parents. But after a few days the youngster's rate of feeding fell off sharply. It reminded me of a child who, eager to share in grown-up occupations, starts off with a burst of enthusiasm, but soon finds the adult tasks harder than they seem and grows weary of them.

Twice I have found groups of three adult Golden-masked Tanagers bringing food to the same nest. In each case all three of the attendants wore fully adult plumage, which is practically the same in the two sexes. They usually came in a little flock, fed the nestlings one by one, then winged away together. They all behaved so much alike that I could not tell which were the parents, or what relationship the helper bore to them.

ALTHOUGH I have found helpers at nests of Golden-masked Tanagers more frequently than at the nests of most other birds, I would not leave the impression that they are of regular occurrence. At only six of the sixty nests of this tanager that I have found did I notice that the parents were assisted by other individuals of their own or another species. The relatively high incidence of helpers at nests of Golden-masked Tanagers is without much doubt a result of the weakness of their defence of the breeding territory. Although they are by no means gregarious in the nesting season, their efforts to drive off intruders are at best slight and ineffectual. Birds of many kinds stoutly oppose the approach of others of the same species to their nests, and even chase their self-supporting offspring of earlier broods away from their later nests of the same season. Were it not for this exclusiveness, they would far more often receive voluntary assistance in their parental duties. But such assistance is not without its disadvantages; for the more bustle and movement there is about a nest, the more likely it is to draw the attention of some predator that will pillage it. Since as a rule the parents are well able to provide for their family without assistance, natural selection would in most parts of the world operate to reduce the frequency of helpers at the nest.

Yet despite the fact that helpers are in most instances not needed, and may even increase the hazards of the nest, this sort of voluntary assist-

ance is so in keeping with the character of birds that many examples of it have been recorded, and their number is constantly increasing as bird-watchers make more careful studies of familiar species and extend their observations to hitherto neglected parts of the earth. As we have already seen in our study of the Golden-masked Tanager, the helper may be of the same species as the parents it assists, or of a different species, perhaps even of a family of quite distinct habits and diet. The conspecific helpers may be scarcely more than fledglings who only a few weeks before became self-supporting; they may be yearling birds who will not themselves breed until two years or more of age; or they may be mature individuals which for some reason cannot find mates, or have perhaps lost their own nests or young. Let us briefly consider each of these classes of helpers.

Each year bird watchers stumble upon unexpected instances of birds giving food to young of other species, or even brooding them. The number of such cases which occur among the birds of the world in a single year must be great, although naturally an exceedingly small proportion of them fall to the attention of people who

not yet laid, finding themselves face to face with the young sapsuckers were stimulated to feed them. In this case the helpers and the nestlings they attended belonged to two different zoological orders. But in the great majority of recorded instances the assistants and the parents they aid belong to the same order, usually the Passeriformes or sparrow-like birds, although often to widely separated families. A Phoebe fed nestling Tree Swallows. A European Nuthatch carried food to Starlings in a neighboring nest, and also removed the droppings of the Starling chicks. An Oregon Junco fed nestling Bewick Wrens. A House Wren brought caterpillars to both the male and female of a pair of Grosbeaks while they sat brooding their own young. Some of this food was eaten by the Grosbeaks and some passed on to the nestlings beneath them; and later the wren fed the young Grosbeaks directly. Afterward this same energetic wren attended a family of English Sparrows. One Catbird mothered orphaned Cardinals, and another fed a half-grown Flicker that was dislodged from the nest and separated from its parents in a storm. Black and White Warblers have been found giving

Nest of the Groove-billed Ani with eight eggs laid by two females. Two or more pairs sometimes build a nest together, laying their eggs in a common heap and all parents incubating.

will record their discovery in print. Since such interspecific associations arise chiefly from chance propinquity, almost any combination of species may occur, the chief limitations being size and mode of feeding. We should hardly expect to find a bird as big as a goose or a stork feeding tiny nestling hummingbirds, nor a young pigeon, which receives a special food in a special manner, to be nourished by a bird that feeds its nestlings with solid particles brought in the bill.

One of the strangest cases that have come to my attention is that of a pair of Mountain Chickadees which were found by an ornithologist in California assiduously feeding a nestful of Williamson Sapsuckers. Apparently the chickadees and sapsuckers had taken possession of neighboring cavities in the same rotting pine tree; the weak partition between the two chambers had broken down; and the chickadees, who had





food to nestling Worm-eating Warblers and a fledgling Ovenbird.

My notes contain many other curious observations of this sort, made by bird-watchers in many countries; but these should suffice to show what odd combinations may develop. The helper is often a male bird who, finding little to do while his mate hatches out her eggs, attends the babies in some neighboring nest. This was the way with a male Scarlet Tanager who brought food to young Chipping Sparrows while his mate incubated; with a Song Sparrow who fed Robins; with a Carolina Wren who gave insects to nestling Crested Flycatchers. At times the intrusion of the uninvited assistant is resented by the nestlings' parents, who may be greatly perturbed by the stranger's visits, but in other cases the gifts of food seem to be accepted as a matter of course. After their own nestlings make greater demands for food, these male helpers usually confine their attention to their own families.

When the helpers are of the same species as the parents they assist, they are of more regular occurrence, for such associations usually spring from the innate character of the species rather than the chance propinquity of nests or such improbable accidents as the collapse of a partition separating two nest cavities. In birds that are strongly territorial, like so many thrushes and finches, conspecific helpers rarely occur; but where defense of the nesting area is weak or lacking, this sort of helpfulness frequently arises. Swallows, which are at all seasons rather gregarious and often nest in crowded colonies, present conditions unusually favorable for the occurrence of helpers, which have been found in numerous species in this cosmopolitan family. Juvenile helpers have been recorded for the European House Martin, the Purple Martin and the Barn Swallow. In the Violet-green Swallow, Tree Swallow and Cliff Swallow, three or more adults sometimes feed the young in a single nest. A number of House Martins may join in the con-

A nestling Banded Cactus Wren of the mountains of Guatemala is well cared for by a helper or two in addition to the parents. Later it will sleep with the attendants in the nest.

struction of one clay nest, and young Barn Swallows not only help their parents to nourish younger brothers and sisters, but may even assist in building a later nest.

Another family in which helpers are often found is the Corvidae. Three adults were seen feeding the young in a single nest of the American Crow, and the same happened at a nest of the Florida Jay. The related Arizona Jays are said to help to build and defend their neighbors' nests. In the big, crested White-throated Magpie Jays of Central America, the incubating female is fed not only by her mate but by other grown birds whose relationship to her is uncertain. At one nest that I watched in Guatemala, the female was kept so well supplied by at least two attendants that when at long intervals she took a recess from her eggs she devoted her time almost wholly to preening and stretching her limbs, finding it unnecessary to supplement the food they brought her. In the White-tipped

Brown Jay, too, the sitting female is given morsels by her mate and sometimes by helpers as well, but at the nests I studied in Guatemala the attendants failed to bring enough to satisfy her hunger and from time to time she went off to forage for herself, leaving her mate standing guard over the eggs. These Brown Jays were particularly favorable for study, as the bills of many were so variously marked with black and yellow that I could recognize them individually. After the eggs hatched, the unmated birds helped the parents to feed and defend the nestlings. Each of the five nests that I watched had at least



one attendant in addition to the parents. At one nest there were five assistants, making seven grown birds who devoted their time to stuffing the three nestling jays. I believe that Brown Jays, like so many other birds, fail to breed in the year following that in which they hatch, and possibly allow several years to pass before they mate; in these intervening seasons they help older birds, probably often their own parents, to rear their families.

The helpfulness of members of the crow family is not confined to the nest. Charles Dar-

win long ago wrote of Indian Crows who fed blind comrades. Recently, when snow and ice covered the ground, a Northern Raven in the National Zoological Park in Washington passed food through the bars of its cage to a free Black Vulture, which took the offerings from the captive's bill.

Another family in which helpers are frequent is the titmice. In her revealing book on *Birds as Individuals*, Miss Howard told how in England a male Great Tit fed the fledglings of a widowed female. Another pair adopted orphaned fledglings, and a youngster placed food within reach of a brother with a broken leg. In the Long-tailed Titmouse, whose beautifully felted oval nests are among the marvels of European ornithology, helpers at the nest have been repeatedly recorded. In the Bush-tits of the Pacific coast of the United States, extra adults sometimes help the mated pair with their nesting activities. While studying the Black-eared Bush-tits in the Guatemalan highlands, I found that the black-faced males were far more numerous than the gray-cheeked females. Those which perforce remained bachelors did not pass the breeding season in idleness, but attached themselves to the mated pairs and shared their labors. Sometimes they helped to build the exquisite, downy, pear-shaped pouch, richly encrusted with foliaceous lichens. After the young hatched, the bachelors joined the parents in bringing minute insects to them, and more rarely took a turn at brooding. At one nest

A young White-tipped Brown Jay from the Caribbean lowlands of Central America should be a robust baby, for as many as seven adults may feed two or three young in a single nest.

at least three males, in addition to the parents, were in attendance, making five adults who labored to satisfy the hunger of the four tiny nestlings. By night four of the grown birds — three males and the mother — slept above the four nestlings in the downy pouch, which gave welcome protection from the incredibly penetrating nocturnal chill of those high tropical mountains. At each of my two other nests of the Black-eared Bush-tits there was a single male helper, who fed the nestlings and slept with them and their parents.

News from the Conservation Foundation

Spreading the Gospel of Conservation Education

Fairfield Osborn, President of the Foundation, delivered an address on the importance of conservation education before the 1954 Convocation of the Board of Regents of the University of the State of New York. Mr. Osborn said in part:

"The great failure of our educational system is that it did not long ago recognize that conservation education, rather than being looked upon as a new subject, should be considered as one as "old as the hills"—essential to the understanding of any citizen. How can we expect the future welfare of our country to be protected unless the youth we educate are intimately conscious of the relationship between natural resources and national wellbeing? War is not the only thing we must strive to prevent. For even if we gain peace, our future will still not be safe unless, through education and positive action, we are assured of the natural resources that are vital to our existence as a nation."

At the invitation of the editors of the Bulletin of the Atomic Scientists, he has also written the guest editorial in this publication on the subject of Technical Assistance and the Point IV programs. This editorial appeared in the March number and contained the following observations:

"It is a startling fact, which Americans have not as yet absorbed, that we as a people, with less than 7 per cent of the world's population and 6 per cent of its land area, are regularly consuming almost half the Free World's volume of materials. No longer is the United States self-supporting as to natural resources. At the start of the century we produced some 15 per cent more raw materials than we consumed. At the present time we are consuming 10 per cent more materials than we are producing. The consequence of this tremendous and ever-increasing use of raw materials reveals an astonishing fact, namely, that the quantity of most metals and mineral fuels used in the United States since the First World War exceeds the total used throughout the entire world in all of history preceding 1914."

Flood Control Controversy Analysis

In view of presently pending legislation dealing with flood control policies of the Federal Government, there occurred an advance demand for copies of the Foundation's study entitled "The Flood Control Controversy—Big Dams, Little Dams, and Land Management" by Luna Leopold

and Thomas Maddock, which was published May 17 by the Ronald Press. The chairmen of the Congressional committees handling this legislation asked that advance copies be placed in the hands of various members and the staff of these committees, and the Department of Agriculture and the Secretary of the Army also requested copies for their use. Review copies with material for editorial comment and news release were sent to 117 western newspapers which have taken active part in flood control discussion over the past year.

Brooks Range Wildlife Study Postponed

The proposed study of the fauna and habitat of the Brooks Range in Alaska under the leadership of Dr. Olaus Murie has had to be postponed until next year due to the illness of Dr. Murie. The ecological reconnaissance study, "Wildlife in Alaska," recently published under the joint sponsorship of the Zoological Society and the Foundation, recommended setting aside an extended wildlife refuge in northeastern Alaska, but the exact boundaries of such a refuge have not been surveyed and detailed information is needed to convince the people and the Territorial Government that this refuge is desirable. It is hoped that Dr. Murie's expedition will supply these two gaps in understanding and will accomplish the objective proposed by Messrs. Darling and Leopold who made the reconnaissance.

Education Evaluation

Dr. Charles E. Lively of the University of Missouri has accepted the Foundation's invitation to direct a survey of conservation education in the universities of the United States and to develop standards for evaluation of such education. Dr. Lively has already commenced work on this project which should take a full year for completion.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Pair of Young Malay Tapirs Now on Exhibition

Since early April we have been able to exhibit three of the four kinds of tapirs of the world — lacking, as it happens, only the common South American Tapir usually seen in zoological parks.

The third species added to the collection is the Malay Tapir, *Tapirus indicus*, represented by a pair of young animals that came to us from Bangkok. We already had a fine specimen of the rare Mountain Tapir, *Tapirus roulini*, and one of Baird's Tapir, *Tapirella bairdii*. It should be possible without too much difficulty to add the South American Tapir, *Tapirus terrestris*, and thus complete the series, for we have exhibited this form many times in the past.

Some twenty years ago the gray-saddle-marked Malay Tapir was quite common and most large zoological parks exhibited it. In recent years very few specimens have been captured, either because of disturbed political conditions in the Malay Peninsula or because the animal is growing rarer as a result of the disappearance of its habitat. As far as we know, only the San Diego

Zoo in this country now has Malay Tapirs besides ourselves.

Our last previous specimen of *Tapirus indicus*, a male, died in 1936. It weighed 520 pounds at death. — W. BRIDGES

Reptile House Re-opening

A detailed report on our re-modelled Reptile House, by Dr. Oliver, will be given in the July-August issue of *ANIMAL KINGDOM*. The building was re-opened with a preview for Members of the Zoological Society on May 26, and to the public on May 27.

Bellbird's Nest Discovered

In a tantalizingly brief note, Dr. William Beebe makes the following report from the Department of Tropical Research station at Simla in Trinidad:

"Following up an unpromising clue, the Department of Tropical Research has chalked up a new discovery: the first nest ever found of the Trinidad (or, for that matter, of any) Bellbird. A full report on the nidification of *Procnias averano carnicauda* will follow in due course."



These young Malay Tapirs are the first we have exhibited since 1936. They have settled down well in their new quarters in the Elephant House, under the care of Keeper Breidenback.

A Good Longevity Record for a Chapman's Zebra

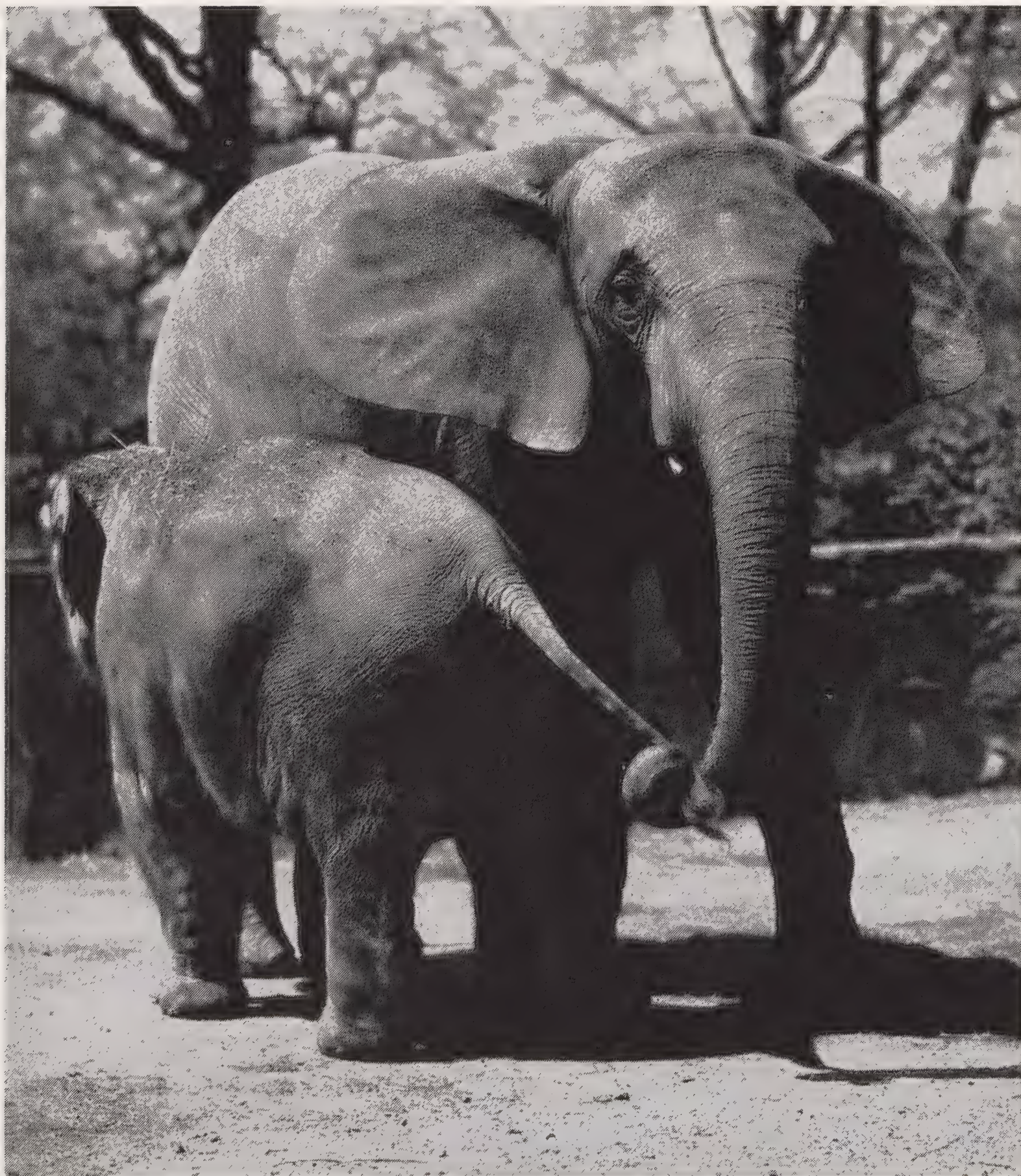
The ages to which animals live — in or out of captivity — are always of interest. For this reason, if for no other, it seems worthwhile to report that a male Chapman's Zebra, received at the Prospect Park Zoo in Brooklyn on May 19, 1929, died there on April 4, 1954. While this record of 24 years, 10 months, 16 days was exceeded by a female Zebra, also a Chapman's, which according to Major S. S. Flower, lived in the Zoo at Basel, Switzerland, for 28 years, 1 month, 24 days, it still is a very long life for a Zebra. Also, there appears to be no other authentic record of a male having lived in captivity for as much as twenty years.

Supervisor of Menageries John Galm, who is in charge of the Zoos operated by the City of New York, in Central and Prospect Parks, furnishes the additional information that the animal was

of breeding age when received, so that at least three to four years must be added to make a full life span of approximately twenty-eight years. Not many domestic horses do as well.—L.S.C.

Brother Joseph, "Okapi Man," Dies in Belgian Congo

The death on January 11 of the Rev. Bro. Joseph Hutsebaut was announced in the January issue of "Zooleo," the magazine of the Société de Botanique et de Zoologie Congolaises, published at Leopoldville, Belgian Congo. Brother Joseph had been attached to the Roman Catholic mission at Buta since 1911. An ardent naturalist, he was the first to capture and keep Okapis, and the first specimen seen in the New World — the animal received by the New York Zoological Park in 1937 — had passed through Brother Joseph's hands. An article, "A Visit to Brother Joseph," appeared in the March-April, 1947, issue of *Animal Kingdom* — W. BRIDGES



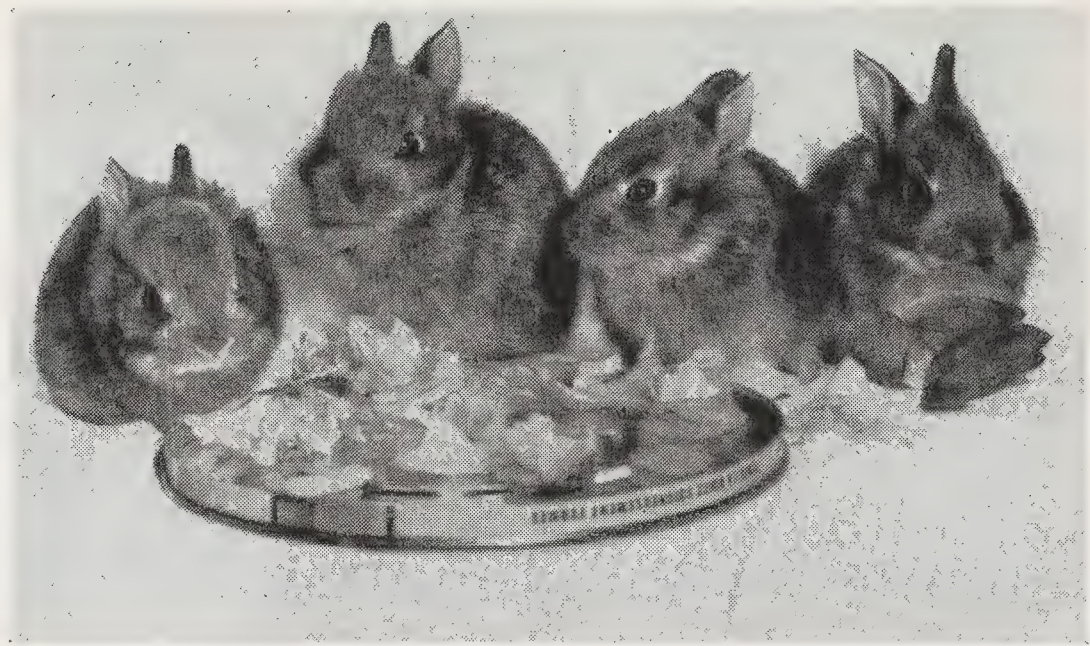
Our young female African Elephant and "Candy," the baby Asiatic female, have taken such a strong liking for each other that it is difficult to separate them even at night. They were put together for the first time late in April, in the yard of the Elephant House.

Director Tee-Van Is President of N. Y. Academy of Sciences

Director John Tee-Van, formerly senior Vice-President of the New York Academy of Sciences, became President this spring upon the retirement of the incumbent because of illness. The Academy, organized in 1817, is the third oldest body of its kind in the United States. — W. BRIDGES

Zoological Park Miscellany

Penelope and Cecil, our Duck-billed Platypuses, were moved from their winter quarters in the basement of the Bird House to their out-of-doors Platypusary on May 7 and went on public exhibition on May 9. A close watch will be kept to detect breeding activities, but courtship was not observed last year until June 21. . . . Evidence is accumulating that a pair of Great Horned Owls is nesting near or in the Zoological Park, and one of the birds is suspected of killing an Ashy-headed Goose in one of the outdoor paddocks . . . Curator Coates and Assistant Curator Atz of the Aquarium have collaborated in writing the section on fish for a 3-volume, comprehensive work, "The Animal Kingdom." Illustrations for their section were made by Staff Artist Lloyd Sandford . . . Eight fawns have been born to our two pairs of Père David Deer obtained from the Woburn Abbey herd in England in 1946, and more are expected this summer. We have sent a young pair to the National Zoological Park in Washington, and a buck to the Chicago Zoological Park, which has also imported a pair. If these pairs breed as well as ours a good start will have been made toward re-establishing colonies of "the rarest deer in the world." . . . Three Jaguar cubs were born on April 11, and we had hopes that the female would rear them properly, since this was her second litter. However, a few days after the birth she began carrying them in and out of her den — a sure sign of trouble — and the babies were given to Mrs. Helen Martini to rear by hand . . . Thirteen reptiles, a Senegal Dove and a Long-eared Hedgehog have been received from the Biblical Zoo in Jerusalem in exchange for a collection of small mammals, birds and reptiles which we sent to that zoo last July. — W. BRIDGES



These four Cottontail Rabbits were an unexpected addition to our collection in mid-April. Workmen setting a new tree in the Elephant House yard uncovered the nest in a dirt heap.

Dr. Gordon Makes Fish Collection in Central America Areas

Living specimens of the striking Lake Peten Sailfin Mollie, *Mollienesia petenensis*, the first seen alive in this country in more than twenty years, were brought back by Dr. Myron Gordon early in April when he returned from a four-weeks' collecting trip to Guatemala and British Honduras. He collected Platyfish from two drainages in British Honduras and one in Guatemala, working in some areas completely unknown ichthyologically. Both living specimens for future genetic studies and preserved ones for statistical analyses were brought back. — C.W.C.

A Special Strain of Carp

Ordinarily the acquisition of some Carp by the Aquarium would not be worthy of comment, but ten young specimens recently received are rather out of the ordinary. They belong to a special strain developed in Israel for succulence, fast growth and resistance to high temperatures. Carp are seldom considered as prime food fish in America, but the fact is that elsewhere in the world more pounds of Carp are consumed than of any other freshwater fish. Our Israeli Carp came to us by way of Haiti, where they have been introduced by the FAO. — J.W.A.

Dacca Has More Cubs

Dacca, our prolific Tiger mother, produced her seventh litter of cubs on May 8. There were 4, all males. One was very weak and died within 24 hours.

PUBLICATIONS OF INTEREST

GEORGE CANSDALE'S ZOO BOOK. By George S. Cansdale. 72 photographs in black and white. 64 pp. Phoenix House Ltd., London and British Book Center, Inc., New York. \$2.00.

Well known as a former Superintendent of the London Zoo, Mr. Cansdale strikes a nostalgic note for readers familiar with the great Zoological Gardens, as well as an informative one for those less privileged. He has written a brief and lively account of life with the animals, of how Zoo specimens are gathered and how they are made familiar to thousands through the medium of television. The photographs include many animal subjects of particular interest and are almost uniformly extremely good. — L. S. C.

THEY NEVER TALK BACK. By Henry Trefflich as told to Bayard Kendrick. Illustrated by 26 photographs in black and white. Pp. 246 + x. Appleton-Century-Crofts, Inc., New York, 1954. \$3.50.

Although obviously intended to entertain and amuse, objectives which it attains with marked success, Henry Trefflich's lively book is actually a factual and reasonably accurate account of the tribulations that beset the course of the present-day animal dealer. It thus will serve a third and very useful purpose as a deterrent to those brash and usually uninformed young men who see only romance and adventure in a career in animal collecting — until they try! — L.S.C.

THE NATURAL HISTORY OF MAMMALS. By François Bourlière. Translated from the French by H. M. Parshley. 24 illustrations from photographs and 97 text drawings in black and white. Pp. xxi + 363 + xi. Alfred A. Knopf, New York, 1954. \$5.00.

This excellent translation of *Vie et Moeurs des Mammifères*, published in Paris, 1951, makes available, in English, Dr. Bourlière's invaluable account of the lives and habits of mammals. In no sense a guide to species identities, it deals exclusively with ways of life: food, homes, reproduction, migration, social life and similar phases, all on a comparative basis. The work is, actually,

a careful collation of results obtained by investigators and offers in a single volume a gathering of factual material that only tireless research could unearth from basic sources. Excellent bibliographies support the many well-selected references.

Compared with the general accuracy of the book, a Llama misnamed "Vicuna" in the caption of an illustration facing page 137 and a Mouse Opossum posing as a marmoset, facing page 232, seem unimportant. — L. S. C.

THE MONKEY BOOK. By Ernest P. Walker. Illus. in black and white from photographs and drawings. 153 pp. The Macmillan Co., New York, 1954. \$6.50.

As Assistant Director of the National Zoological Park in Washington, Mr. Walker has had ample opportunity to learn what people most want to know about the natural history of the monkey tribe and about the care of these animals as pets. Animal information centers will greet this volume with particular pleasure, for a source book that can be recommended with confidence has long been needed. The illustrations are excellent and there is a useful bibliography. — L. S. C.

PRIMATES. Comparative Anatomy and Taxonomy. I: Strepsirhini. By W. S. Osman Hill. Pp. 798 + xxiii. 34 plates in black and white, 199 illustrations from line drawings. Interscience Publishers, New York; University Press, Edinburgh, 1953. \$12.50.

The first volume of this monumental work which will replace D. G. Elliott's "Review of the Primates," published in 1913, is devoted to the Lorises, Galagos and the Lemurs and their relatives. Under species descriptions, behavior and anatomy, present knowledge of these primitive groups is thoroughly covered. Preceding the more detailed body of the book is a general consideration of the Order Primates. Here, the outstanding features are the removal of the Tree Shrews from the Primates altogether and the elevation of the Tarsiers to higher rank. In a work of such magnitude (six volumes will be required for completion) it is inevitable that some disagreements must arise. These, however, in no way detract from the general value of the undertaking. —L.S.C.

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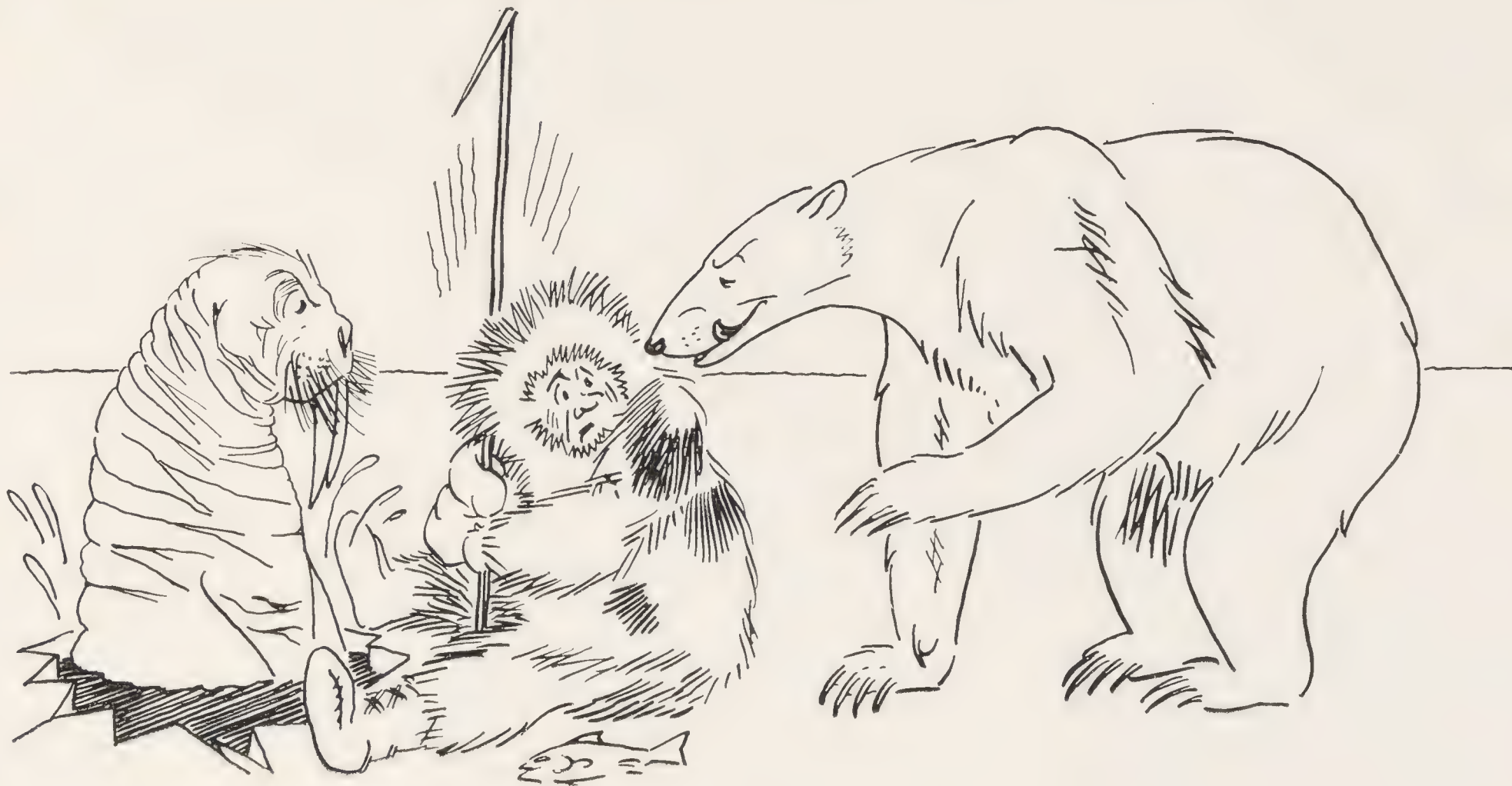
Mrs. Edwin Schlesinger

Arthur B. Singer

Charles G. Thompson

Albert Wagenknecht

Mrs. Mary Anne Waly



"All right! All right! I'm only fishing for some new members for the New York Zoological Society."

We are grateful for the names of your many friends who should be enjoying our membership with its many unusual privileges.

Send us their names, please — or you can make them gift memberships. Annual membership is \$15.00, and Contributing membership \$25.00 a year. The latter is tax-deductible, we understand.

MEMBERSHIP DEPARTMENT
New York Zoological Society
30 East 40th Street
New York 16, N. Y.

P. S.—Please send us your summer address if you wish to receive *Animal Kingdom* on time.



LVII • No. 4

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JULY-AUGUST, 1954

ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Odyssey of Money

This is the second of a series of brief editorials to illustrate the fruitful ways in which money given to our Society can be used.

BY FAR the greater part of our money is used right here at home. The Zoo and the new Aquarium make imperative demands for funds that need to be spent not only for physical improvement but for the welfare of our employees, averaging more than 300 in number. However, our Society was also chartered to serve other purposes, involving the advancement of zoology and protection of the wild animal life of the world.

Three years ago we woke up to the fact that many European zoologists were in a straight-jacket as far as money was concerned and it behooved us, as a fortunate American institution, to give them a helping hand. Thus we established our own Point IV Program — small but potent. The results proved infinitely worthwhile, even the smallest grants drawing heartfelt appreciation from European scientists. For instance, we sent merely \$70. to a zoologist in the Max Planck Institute in Westfalen, Germany, to enable him to buy some publications he urgently needed for his studies of animal behavior. He sent us the following acknowledgment: "The generosity with which you further our investigation plans rouses in me an ever and again deep feeling of shame, that we — at least for the time being — are not able to offer you things likewise . . . Words are too less for my heaps of hearty gratefulness!"

Another scientist in the Royal Institute of Natural Science, Brussels, was engaged in studies of the nightly migrations of birds and we sent him \$150. to buy batteries and lights for his observations. He wrote: "This help allows me to execute a long cherished project."

We sent \$120. to another scientist in the Zoological Institute, University of Vienna, who was engaged in some research on aquatic life. He later wrote us: "Your Program is a wonderful deed of real international thinking in science matters, which I truly admire."

The program was made possible only because of the existence of funds representing an accumulation of gifts and legacies that had been made to the Society from time to time in the past. We maintained this program for two successive years, aiding the work of forty-eight individuals attached to thirty-eight different scientific institutions in thirteen countries, at a cost of less than ten thousand dollars. With considerable regret we have found it necessary to terminate the program this year because of more immediate demands upon our finances. But it did much good, advancing the cause of zoology and creating new bonds between our institution and scientific co-workers in countries abroad.

Fairfield Osborn

AUG 16 1954

We Dedicate—

“THE MOST BEAUTIFUL REPTILE HOUSE IN THE WORLD”

AT 3 P.M. on the 8th of November, 1899, Professor Henry Fairfield Osborn delivered the address of dedication at the opening of the New York Zoological Park. Only two permanent buildings were completed on that date; one of them was the Reptile House. As befits the dedication of an institution, Professor Osborn spoke in broad terms. The Zoological Park, he remarked, was established for the purpose of bringing the wonders of natural science “within the reach of thousands and millions” of all walks of life. He spoke prophetically, for in the seven weeks between November 8 and the end of 1899, ninety thousand persons journeyed to the distant Bronx to see the new Zoological Park.

A little more than half a century later and again a few minutes after 3 o'clock, on the 26th of May, 1954, Fairfield Osborn as President of the Zoological Society dedicated anew the Reptile House — rebuilt from roof to basement. In his brief talk he amplified the operational philosophy expressed on the earlier date by his distinguished father. “This occasion in honor of reptiles marks just another step forward in our determination to make the Bronx Zoo the most beautiful and the most interesting place of its kind in the world,” he said.

And, as an indication of the continued and increased interest of the “thousands and millions,” 116,164 persons visited the Zoological

By
**JAMES
A.
OLIVER**



Park in the single week-end — two days — following this second opening of the Reptile House.

The late Dr. Raymond L. Ditmars, the Society's renowned and first Curator of Reptiles, was largely responsible for the design and equipment of the original building. In its beginning and for many years thereafter it represented the most advanced techniques of the times. In those early years Dr. William T. Hornaday wrote enthusiastically: “There seems to be no question regarding either the attractiveness of the Reptile House, or its fitness to meet all the requirements of its living contents. It is only the echo of public sentiment to assert that it is a success. On all Sundays it is densely crowded with visitors; but were it five times its present size, standing room would be at just as high a premium as now.”



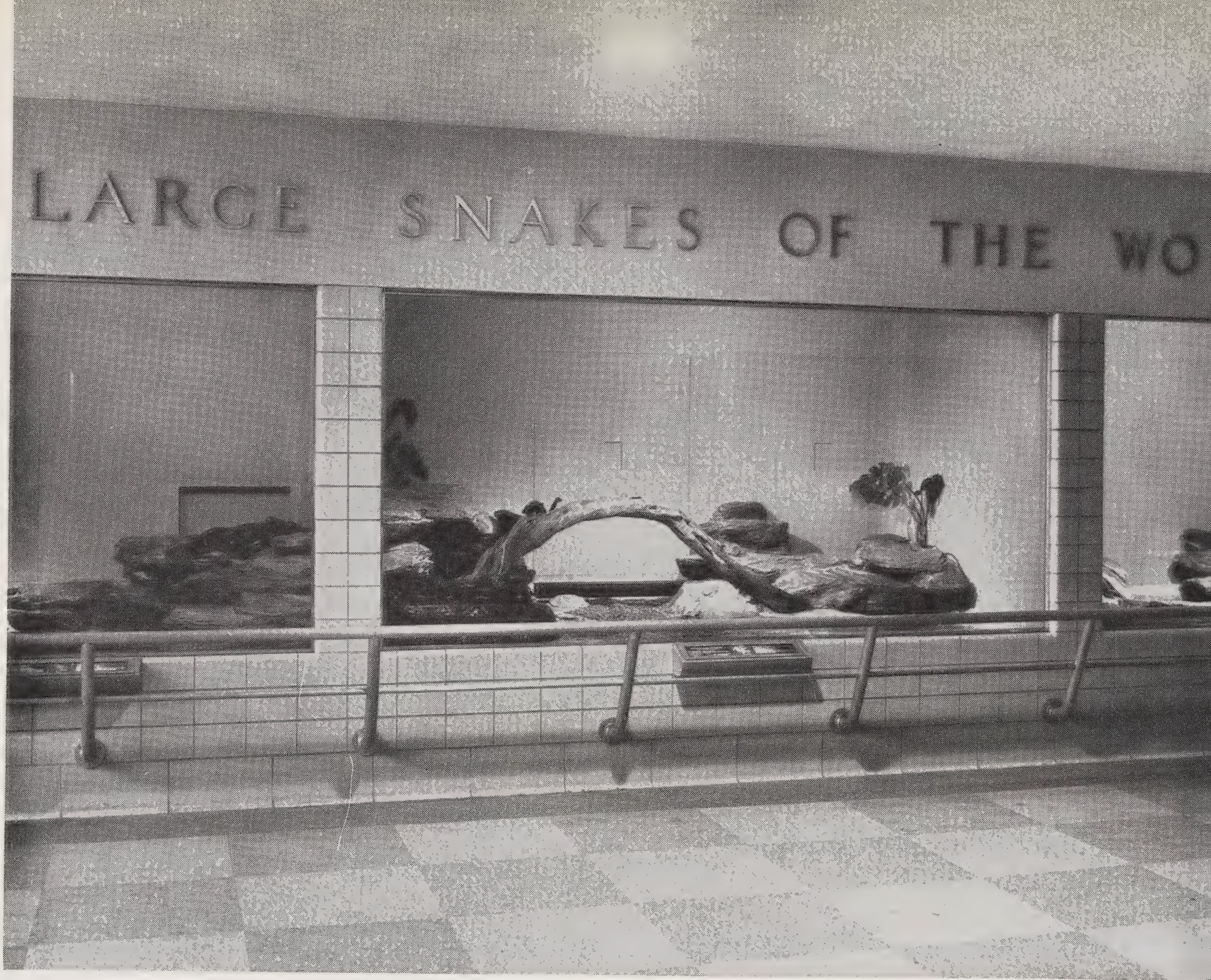
The same words are applicable to the remodelled building, except that the first sentence of Dr. Hornaday's comment seems too pallid for our present Reptile House.

With the passage of time, the attrition inevitably associated with great crowds, the considerable increase in our knowledge of reptile biology and the improvement and development of technical skill in architectural engineering, the original Reptile House became antiquated and inadequate. Specimens could no longer be exhibited in attractive or even adequate physical settings, and so, after long consideration and careful planning, reconstruction was started early in 1952 — literally from the roof down. Exhibition was maintained, although with difficulty, while a new copper roof was being put in place, but when the

Blue-green tile, tropical plants and a lavish use of color in cage backgrounds create an impression of beauty that will, we hope, lessen the dislike some people have of reptile life.

roofers departed the building was definitely closed and the interior was cleared from wall to wall. Within a few weeks only the strong steel girders of the roof and the sturdy outer walls remained of the original building. Within this shell we have built a strikingly modern exhibit.

The first requirement was simple in concept: we wanted a building in which a large and varied collection of amphibians and reptiles could be properly and comfortably housed in compartments that simulated their different physical requirements. This meant living areas of many



types. The old idea that all reptiles thrive at one constant temperature — just as long as the temperature is high — has been shown to be wrong. A modern Reptile House must provide a variety of temperature conditions not only from cage to cage, but even within the individual compartments. This latter provision permits each animal to select the degree of warmth most suitable for its varying activities. Temperatures in our new cages can be controlled individually or in units, and they vary from front to back in each cage, the rear being cooler than the front. Radiant heat pipes are embedded in the front floor and thus by making this area warmer than the back, the specimens are induced to remain more constantly up front where they can be clearly seen by the public. Instead of a single temperature throughout the building, we now have compartments in which the base temperatures vary from 65° F. to 90° F. No single cage has a temperature range as wide as that, but each one may grade up or down from its own base temperature by as much as 5° F. — a range of considerable magnitude where reptiles are concerned.

The big pythons and anacondas, some of them 20 feet long, catch the visitor's eye when he enters the Reptile House. The largest of these compartments is 11 feet long by 6 feet deep.

Light conditions also are varied from spot to spot and the large enclosures are provided with ultraviolet or infrared bulbs. All large cages have individually regulated mechanical ventilation systems. The water piped to all pools, big or little, is thermostatically controlled and mixed so that only warm water is brought in contact with the reptiles. Several enclosures have fog nozzles to maintain high humidity, for we know that some snakes that come from wet forest areas require considerable moisture in their environment. Otherwise they have difficulty shedding their skins and become sickly.

For very nervous snakes one-way-glass is provided, so that the visitor can see into the cage but the snakes cannot see the visitors — they see only a reflection of themselves as in a mirror. The value of these installations is shown by the reaction of two large Eastern Diamondback Rattle-



snakes. This species appears to be quite nervous and is difficult to keep in captivity. In exhibition cages faced with ordinary glass, rattlesnakes usually rest in a coil at the rear, as far away from the public as possible, and their heads are directed toward the front of the cage where they perceive the motion of passers-by. In their one-way-glass cage our two Diamondbacks are usually found to be at the very front, in plain view of visitors, and their heads are likely to be directed toward the rear door. Only there, and then only at infrequent intervals, are they alarmed by any motion, as when a keeper walks through the passageway and his shadow falls on the ventilation grill. The nervous tension of these snakes is markedly decreased.

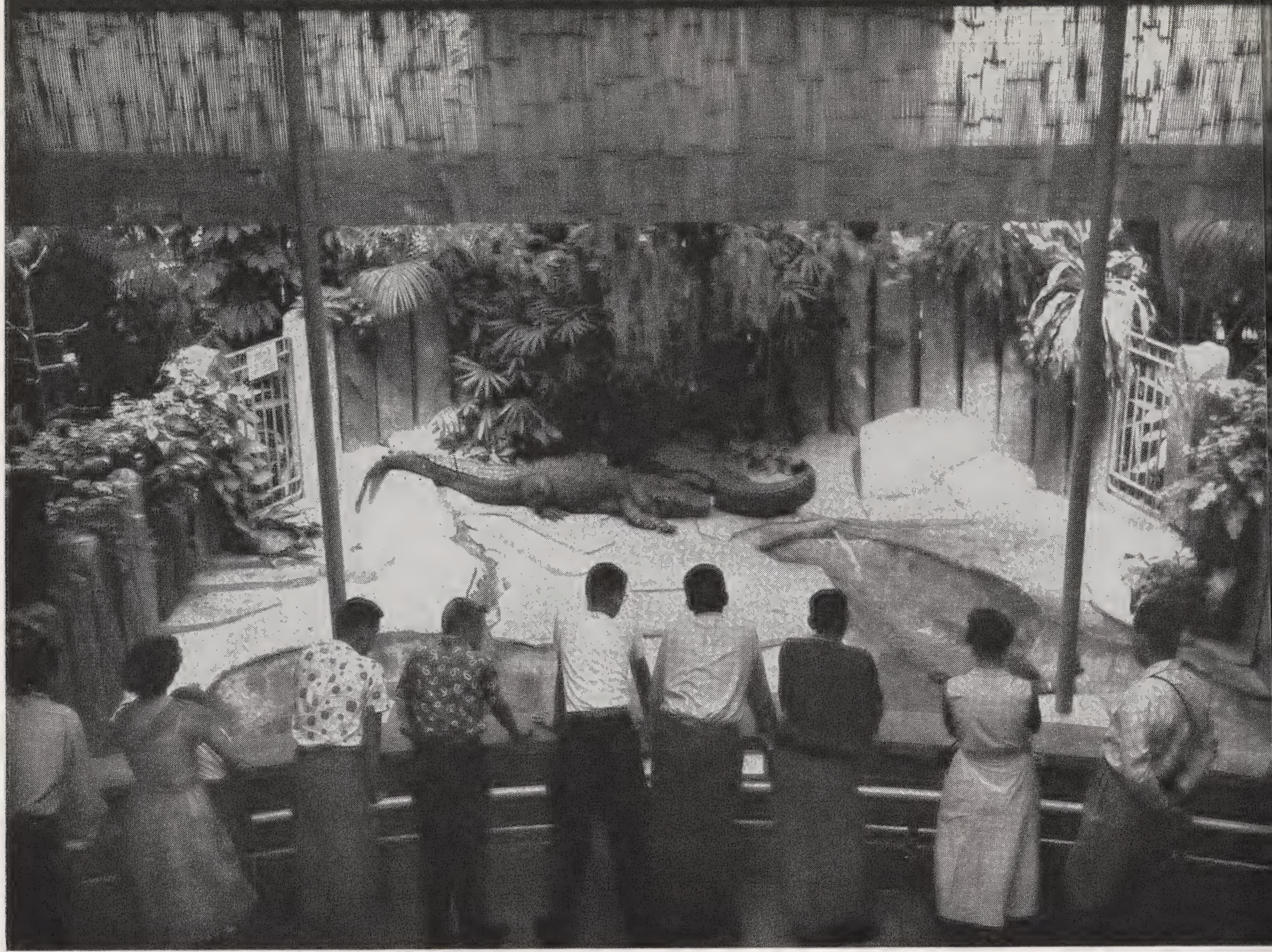
The simulation of natural settings came first, but eye-compelling attractiveness was only technically second in our planning. Indeed, it was considered so important that President Osborn wisely suggested calling in professional consultants to work out the details of decoration, color and planting.

As a result of this specialized assistance, there

Looking down the corridor toward the west, past the large snakes of the world, the Alligator Swamp inevitably attracts the eye. Exhibits of local snakes are set in the wall at the left.

is a bold continuity of design from the flowing curved wall of the Alligator Swamp through the corridors leading back to the Nile Crocodile and Galapagos Tortoise exhibits at the opposite end of the building. Colored tile, subtly varying cage background colors and the intricate forms of weathered driftwood mark differences yet maintain the feeling of unity. Color — a great deal of it — is certainly first impression formed by a visitor; it is heightened in the Alligator Swamp by two well-behaved Macaws perched on either side of the central pool.

Since this building will undoubtedly be the first introduction to reptiles that millions of children will have through the years, we were determined to make it as pleasant as possible. Music, it seemed, would add to the effect, so symphonic music now gives a muted background of sound to the public space.



The educational aspects of animal exhibition — the business of telling people the interesting and important things about animal life — have always dominated exhibition planning in the New York Zoological Park. Here we had a prime opportunity to organize certain exhibits around a single theme and to give information about amphibians and reptiles in easily-understood terms. These displays combine zoological exhibition with museum techniques and utilize living specimens, large chart diagrams, mounted eggs and skulls. Bulletin board types of exhibits were slipped into space that could not be used otherwise. These give information on such things as relationships and history of amphibians and reptiles, tooth modifications and the classification of venomous reptiles, maximum size of reptiles and the care of pet turtles. Transparent labels have been used for the major series of cages and they give the common and scientific names, a map of known distribution and brief information about maximum size, food, reproduction and the pertinent facts of behavior or natural history. Where reptiles of different species occupy the same compart-

Natural sunlight, broken and diffused by a series of bamboo curtains, floods the Alligator Swamp in the afternoon. There is a deep pool for the 'gators in the foreground of the Swamp.

ment, the labels give the markings by which they can be distinguished.

There is, consequently, a wide variety of educational fare; it is "cafeteria style," and it permits the visitor to take so much as he desires, whether it be a mere identification or a somewhat complex exposition of reptile history from the ancient past to the present.

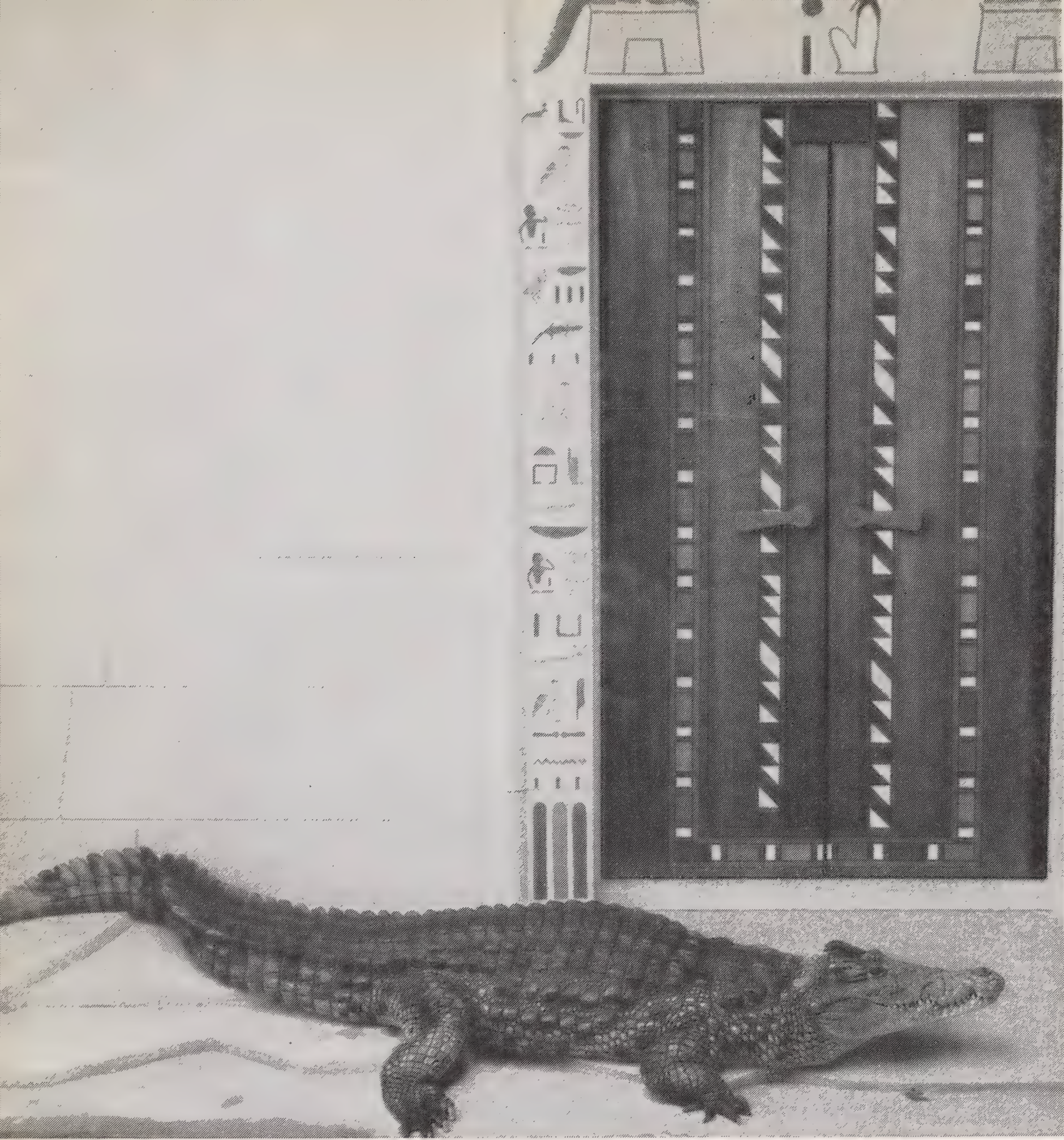
A perplexing problem in working out the overall design of the building was that of space. More room would be needed if we were to have a large and diversified exhibition worthy of the decor. In order to increase the number of cages and enlarge the visitor area, virtually all the main floor was given up to exhibition; only the necessary rear servicing passageways were subtracted. This meant extending exhibits into the east end of the building, formerly employed only for storage, and incorporating the "conservatory" in the west



ABOVE — Each compartment varies in color of its background and in its planting, the latter suggesting the reptile's habitat. BELOW — A typical cage, for reptiles of the desert.

end in the Alligator Swamp. By these means, and by putting more exhibits on a double level, we have been able to add 33 compartments, making a total of 94 exhibition enclosures in the building. These additions include three new turtle and crocodile pens, three large aquarium tanks for turtles, five small compartments for frogs and 22 homes of varying sizes for lizards and snakes. Not apparent to the public but most important operationally, four shift cages were built alongside the enclosures of the more deadly and larger snakes, so that they can be confined in a small holding area on occasions when it is necessary for their keepers to enter their living quarters for cleaning or some other reason. And, too, when two voracious feeders are exhibited together, it is valuable to be able to lock one up while the other feeds; that way there is no dispute as to which gets the most.





Heat pipes just in front of the doorway cause the Nile Crocodile to spend much of its time there. The inscription around the door is an invocation of Sobek-Re, a god of the ancient Egyptians.

Safety — for the animals, the keepers and the public — has been very much to the fore in our planning. Admittedly there has been some compromise, but we think a justified one. To make all our turtles completely safe from the pellets, paper cups, popcorn and pocket combs tossed at them by *some* children, we would have had to confine them behind glass. The “Crocodilian Nursery,” where young crocodilians are exhibited among twisted driftwood, was a similar problem. We felt that the hazards of exposure to a fraction of the public did not justify shutting the turtles and small crocodilians behind glass, and thus they are in the open.

In the snake cages, however, we went the limit in insuring safety. The exhibition glass fronts are set in metal frames, and so are the service doors at the rear. They are tight-fitting and non-warping, guaranteed to resist the effects of heat and moisture. Each door in the permanent cages is fitted with a small inspection opening that permits the keeper to observe the location of the snake *before* he opens the door. If there is the slightest doubt about the safety of opening, he

has only to move the snake into the shift cage. To make assurance doubly sure, four of the cages designed to house the most dangerous snakes, such as Mambas, King Cobras, and the larger constrictors, have access doors in the ceiling. It is easily possible to work from above to direct a snake into the shift cage if it is reluctant to leave.

Lighting fixtures are all serviced from above instead of from the interior of the cage, for even though there may be a convenient shift cage, we want to avoid, as much as possible, the disturbance of the reptile that shifting inevitably involves. So, again, with the water supply; the pools in the large, permanent cages can be drained and filled without opening the door.

In the public space the guard rails are anchored in the wall that is flush with the front of the compartments, so that there are no stanchions or braces to trip the unwary. In the original building there was but one public means of entrance and exit; now we have two — a new, wide door, to be opened in case of need, has been set in the east end of the building.

It should be apparent at this point that in start-



Our Galapagos Tortoise collection now has ideal quarters behind glass, with a sandy area on one side and a shallow pool. The big Tortoises are fond of water and are in it almost daily.

ing virtually from scratch and designing a close-to-ideal Reptile House, we have been concerned very greatly with the comfort and well-being of the inmates. That concern goes even further, for we now have for the first time an adequate storage and laboratory space. It was obtained by the simple device of building a mezzanine floor, a sort of second-story, without raising the roof or otherwise changing the exterior of the building. Not only does it provide work space and laboratory room, but it makes for better visibility of the exhibits by darkening the public space.

In any reptile collection, there are bound to be many specimens for which there is no immediate exhibition space. Our mezzanine allows us to hold these indefinitely. Scientifically, indeed, this gallery is the most important part of the new building, for here we hope to learn many important facts about the biology of reptiles. There is a snake-proof quarantine room where new arrivals can be observed in isolation before they are placed on exhibition, a large variable-temperature cage for studying the temperature and humidity requirements of our specimens,

insect culture boxes for rearing some of the insects used as reptile food, storage space for equipment and the controls for the music in the public space.

In the long run probably no other single element in the Reptile House will prove to be as valuable as the plain, gray "Question Box" in the mezzanine laboratory. For many years it was thought that all reptiles were heat-loving animals with wide variations in body temperature and that they kept their temperature within a degree or so of their environment. Experiments by a number of recent investigators have taught us to give more careful attention to the temperature factor in the biology of reptiles. We now know that they have a more or less constant temperature when they are active and that species differ in their temperature needs. We know that within the range of toleration virtually all life functions are carried on more rapidly at higher than at lower temperatures; that there are temperature limits below which some functions cannot be performed sufficiently well for survival. By the same token, there are upper temperature limits



at which animals cannot live for very long. Reptiles, particularly snakes, very definitely can be killed by exposure to high temperatures.

Unlike mammals and birds that derive heat mainly from within their own bodies by the oxidation of food, reptiles, amphibians and fishes depend on external sources of heat. Through their behavior they orient their bodies towards or away from the sources of heat and thus keep themselves close to the average activity temperature of their kind. While they are digesting a large meal they generate some internal heat, but this is slight in comparison with the temperature needed for normal activity.

We know *some* of the temperature factors that enter into the successful maintenance of a large collection of reptiles, but we do not know the detailed needs for any species for all its activities. In the Question Box — a variable temperature apparatus — we expect to learn facts that we can put into application in our exhibition cages.

The box itself is a mere wooden structure eight feet long and six feet wide. It is divided lengthwise by a solid vertical partition with a low

Feeding time in the Crocodilian Nursery is one of the highlights of the afternoon. The young Alligators come to the edge of the ledge to be fed with bits of fish by one of the keepers.

central opening at the bottom. One side of the partition is kept dry, the other moist. Four individually controlled heating cables are buried under four inches of earth in the floor. They can be set to give a desired temperature gradient from one end of the box to the other.

In the Question Box, then, a reptile can have its choice of environments: hot-and-dry, warm-and-dry, cool-and-dry, or hot-and-moist, warm-and-moist or cool-and-moist. A screen top permits us to note what a given specimen prefers under given conditions — and when it is ready to go on exhibition we will be able to duplicate those conditions, thanks to the temperature and humidity controls in individual exhibition cages.

SO MUCH for a description of the actual building — but what of the collection on “reopening day” on May 26? We have no record of the



complete collection in the Reptile House on November 8, 1899, but it is highly doubtful if it approached our present collection, for efforts were too dissipated in opening the whole Zoological Park to concentrate as we were able to do. Our former excellent exhibition of reptiles was of course seriously depleted as the time for the re-opening drew near; in part naturally, but largely purposely, for the building had to be completely emptied for many months and there simply was not storage space elsewhere in the Zoological Park for all the specimens. They had been sold, given away and exchanged with promise of repayment later. When the time for replenishing came, we realized the worth of our friends in all parts of the world. It is, in fact, no exaggeration to say "in all parts of the world," for specimens came flooding in from near and far. Fellow herpetologists at the San Diego Zoological Park had been saving choice specimens for us for almost a year. A friend in Ceylon hastily got together material in response to our call for help; another in Nyasaland sent us the only Giant One-horned Chameleons on exhibition in this

Museum types of exhibits are combined with living specimens along the south wall of the Reptile House. Visitors start their tour here and can learn many general facts about reptiles.

country; others sent rare frogs from the Hawaiian Islands and Panama and snakes from Africa, Australia and Panama. Not all the contributors were so distantly placed, of course. Some in Manhattan, Staten Island, the Bronx, Brooklyn and Bear Mountain helped out most generously.

Nor was this last-minute outpouring without incident. One collector in Australia was bitten by a venomous snake he was trying to bag for us and subsequently went through what he laconically described as a "rather rough time." In our own southwest we had engaged a professional collector to send us a subspecies of Copperhead at an agreed price of \$2 each. The snakes came, and the bill — at \$2.50 each. The collector explained the increase in his price by the fact that he was bitten by one of our snakes and had to spend \$11 for serum and hospital treatment, and he hoped we would not object to a price that

would repay part of his outlay. We didn't object.

As always in the gathering of a large collection, the reputable animal dealers provided some of the unusual and most of the more familiar foreign species. Perhaps the most spectacular single exhibit on "opening day" was a large female Indian Python incubating her eggs. She was purchased from an animal importer and arrived just two days before the building was reopened. On the way to this country from India she deposited her eggs in the shipping crate. Pythons are unusual among snakes, in that the female coils about and actually incubates her eggs, instead of simply depositing them in rotting vegetation or some other protective medium and leaving them to hatch by themselves, as most egg-laying snakes do. When the snake arrived we worried about the business of moving her from her box into her new home without disturbing her to the point of abandoning her eggs. She was finally covered with canvas and lifted

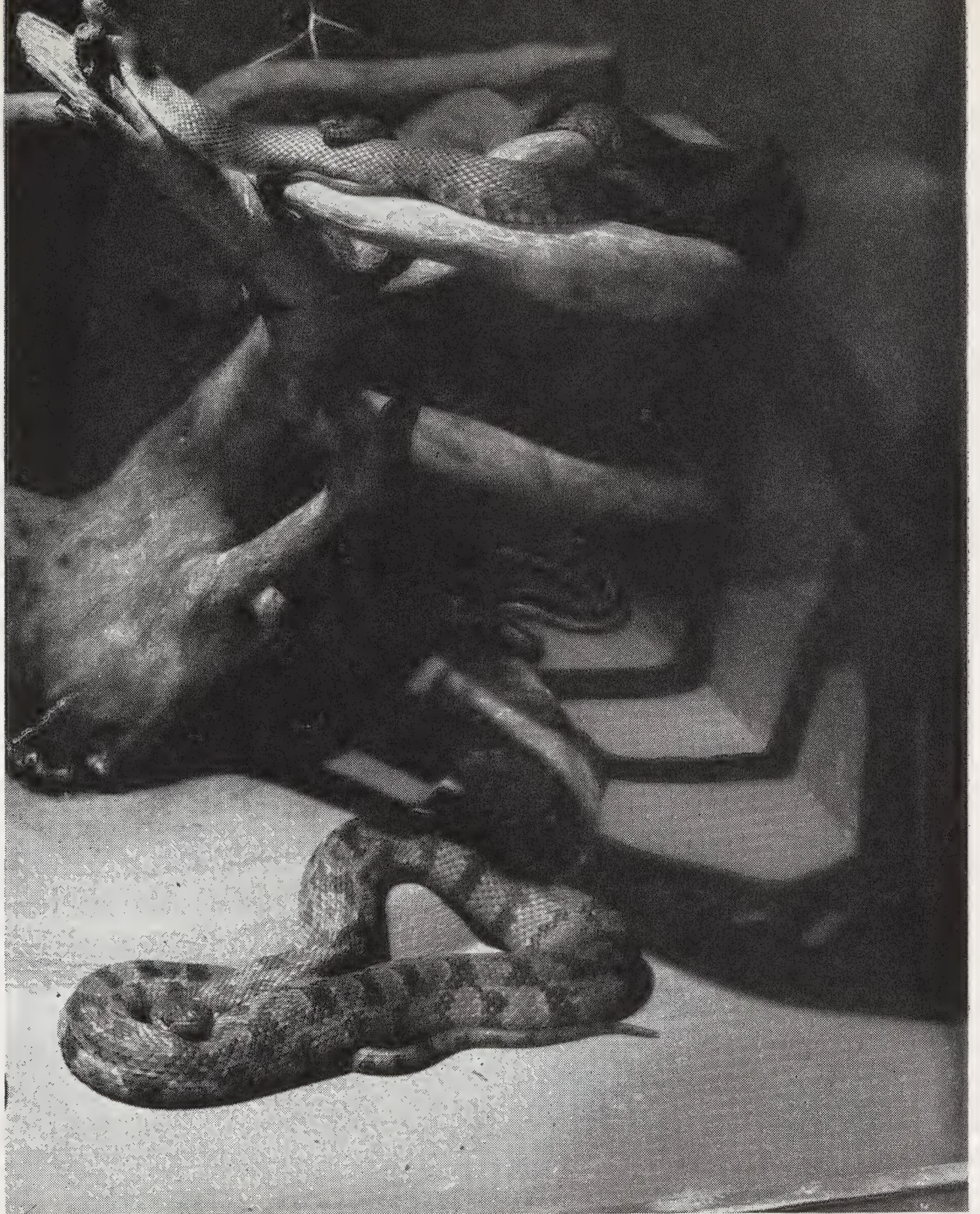
The second-story laboratory contains a snake-proof screened room for holding newly-arrived specimens. The big gray "Question Box" will solve temperature and humidity problems.

bodily, eggs and all, into the front of her compartment. Luckily this did not alarm her too much and she remained coiled, although she did make a warning strike or two when approached too closely. There was a most happy sequel to her incubation and the results of her efforts are pictured on the cover and on pages 112 and 113 of this issue of *Animal Kingdom*.

This article has set forth some of the many considerations that went into the making of our "new" Reptile House. Set down one by one, they seem to be isolated aims, but actually they are blended more or less unconsciously in the formula that brought the building to reality. The degree to which they were achieved is attested by the exhibits themselves. Because of the happy combination of efforts that expressed these aims, we take pride in claiming to have the best Reptile House in the world, and the most beautiful. It is not the best because of any one feature, but because of the amalgamation of special treatments. In the words of two of the Zoological Society's Presidents, spoken so many years apart, the building is truly "another step forward in our determination to make the Bronx Zoo the most beautiful and interesting place of its kind,"



Many persons in many parts of the United States contributed decorative material that made it possible to create compartments such as this striking one.



where we are bringing the wonders of natural science "within the reach of thousands and millions."

IT IS A FINAL PLEASURE to record the names of those who created the building and its exhibits. Architects of the over-all alterations were Edward C. Embury and Nicholas K. Lucas, with Aymar Embury II as consulting architect. The contractor was D. Fortunato, a member of the Zoological Society. The interior designs and decor were supervised by Harmon H. Goldstone with the assistance of color consultant Teresa Kilham, sculptor Edward S. Maps and horticulturist Thomas Everett, the latter on the staff of the New York Botanical Garden. The final installations and last-minute modifications were swiftly and expertly performed by the construction personnel of the Zoological Park, and the entire remodelling program was under the capable supervision of Quentin M. Schubert, our Superintendent of Construction and Maintenance.

It is possible to mention only a few of the contributors to the decoration of compartments. Coral rock was donated and shipped to us by

E. T. Collier of the Naranja Rock Company, of Naranja, Florida. Some time ago great quantities of black pebbles were collected by the children of Greece on the island of Rhodes and were sent to the United Nations for use in a fountain; part of the surplus was made available to us by David Vaughan, Assistant Secretary General of the U.N., and the Greek Ambassador to the U.N. Half a ton of surplus rock crystals, beryl, serpentine, mica and other stones was donated by the Department of Mineralogy of the American Museum of Natural History. Large Saguaro cactus skeletons were given to us by J. E. Thompson, Jr., of the Boyce Thompson Southwestern Arboretum at Superior, Arizona. Curious and beautiful pieces of driftwood were obtained from Ned Thomas of Brooklyn. The Metropolitan Museum of Art, through its Department of Egyptology helped to create the attractive and authentic design of the doorway in the Nile Crocodile enclosure. There were many other eagerly cooperative individuals and institutions. We — and the reptiles that benefit thereby — owe them all gratitude.

THE UNPREDICTABLE PLATYPUSES

By ROBERT M. McCLUNG

LAST YEAR at this time, as members of the Zoological Society will recall, we thought that Penelope, our female Duck-billed Platypus, had babies in an underground nest. All her actions during the summer of 1953 seemed to point in that direction.¹ It was with high hopes, therefore, that we dug into the nesting bank on November 5. We found Penelope, all right — but no babies.²

Penelope and Cecil were promptly placed in their indoor winter quarters, and we closed up the outdoor Platypusary for the winter, vowing to give the matter of breeding Platypuses another good try this year. We determined to put them outside as early as weather permitted this spring, to give them the best chance possible. On May 7 they were placed outside, and we began to exhibit them on the 11th.

Our strategy was as follows. Each day Penelope was exhibited from 2:00 until 3:00 p.m. Then Cecil was ushered into his exhibition pool before Penelope was allowed to go back into her wooden burrows. In this way, she could easily be aware of the male Platypus in the adjoining tank, for there were several wide cracks in the partition between the two tanks. If she showed any interest, we would be able to observe it at once.

On the afternoon of May 18, Keeper John Blair observed that as soon as Cecil was put out, Penelope swam over to the partition and began scratching and nuzzling at the door. The door was opened, the two animals came together, and immediately began preliminary courtship and playing in typical Platypus fashion. Cecil seized Penelope's tail, and they slowly swam in circles.

This alternated with much nuzzling of each other's back and tail.

Daily thereafter, from May 18 until June 10, Penelope and Cecil were allowed to be together for an hour or more each afternoon. Courtship continued vigorously. Cecil took the initiative each afternoon and pursued the not-unwilling Penelope. Courtship usually started with Cecil seizing Penelope by the tail. This action was accompanied by a great deal of mutual nuzzling and "barrel-rolling." In this maneuver Penelope would roll over and over in the water, seemingly trying to break loose from Cecil's grip on her tail. When she was successful, however, she would usually swim back to him. Both animals seemed to tire of aggressive courtship after about an hour's time, and be more interested in feeding.

All during these three weeks, the Platypuses were under constant surveillance while they were together. We wanted to know when actual mating occurred, if possible. Penelope had not yet been allowed access to her clay bank, for once she had dug burrows she would not be available except when she chose to come out. Our idea was to wait until we were fairly sure that actual mating had occurred before letting her dig her burrow and build her nest. Observations in Australia by David Fleay indicated that there was a period of approximately two weeks between mating and the actual laying of eggs. This would give Penelope the time necessary to dig her burrow and prepare her nest.

An alternate course of action would have been to open up the clay bank, and also take away the pool barrier so that the Platypuses could be together whenever they desired. If we did this, we would not know whether Penelope got enough to eat, for she usually did not enter the pool of

¹ THE OUTLOOK FOR A BABY PLATYPUS. *Animal Kingdom*, Sept.-Oct., 1953, p. 146.

² NO BABY PLATYPUS! *Animal Kingdom*, Nov.-Dec., 1953, p. 162.



her own volition before 8:00 p.m. or even later in the evening. By this time, Cecil could have eaten most of her earthworms and crayfish ration, as well as his own.

It was not until June 1 that we observed a behavior variation that may have been actual mating. The complex maneuvers were repeatedly observed and were photographed in motion pictures by Staff Photographer Sam Dunton. A technical description, with illustrations taken from the motion picture film, will be published later in the Zoological Society's scientific quarterly, *Zoologica*.

On June 10, reasonably satisfied that Penelope had been mated, we allowed her access to her clay bank. That night she commenced to dig, and thereafter spent most of her time in the clay bank. She was in her wooden burrows, however, the next day, and was put in the pool with Cecil. Courtship behavior similar to the previous day's took place. After this episode, Penelope dug almost nightly in her clay bank and remained in it during the day. She came out to feed about 8:00 p.m. or shortly thereafter each night, except the night of June 14, when she did not appear at all. On three occasions

This is Platypus courtship. Cecil, the animal in the lower part of the picture, has seized Penelope's tail in his beak and they are beginning to swim in slow circles. Apparently this act has never before been photographed.

since then the two animals were put together in the evenings, but their interest in each other seemed mild.

If Penelope had actually been mated, we calculated that somewhere around June 25 she would retire into her nest for a week to lay and incubate eggs. Dried eucalyptus leaves were nightly floated in her pool for use in nest building; but she ignored them. June 25 came and went with no change in Penelope's behavior. She came out each evening to feed. By the first week in July it seemed clear that nothing was going to happen.

And that's where we stand at present. We have again shut Penelope out of her clay bank so that we can start all over again, putting the two animals together daily to see if they are interested in courting. If so, who knows? Platypus behavior — at least the behavior of Penelope and Cecil — is unpredictable.

ZOO NEWS IN PICTURES

Photographs
by
SAM DUNTON



THE FIRST BLESSED EVENT IN THE REPTILE HOUSE

LOWER LEFT — This was the sight that greeted our guests on opening day of the Reptile House — a 15-foot Rock Python coiled around her eggs. This picture is by Al Ravenna, staff photographer of the New York World-Telegram & Sun, made May 26.



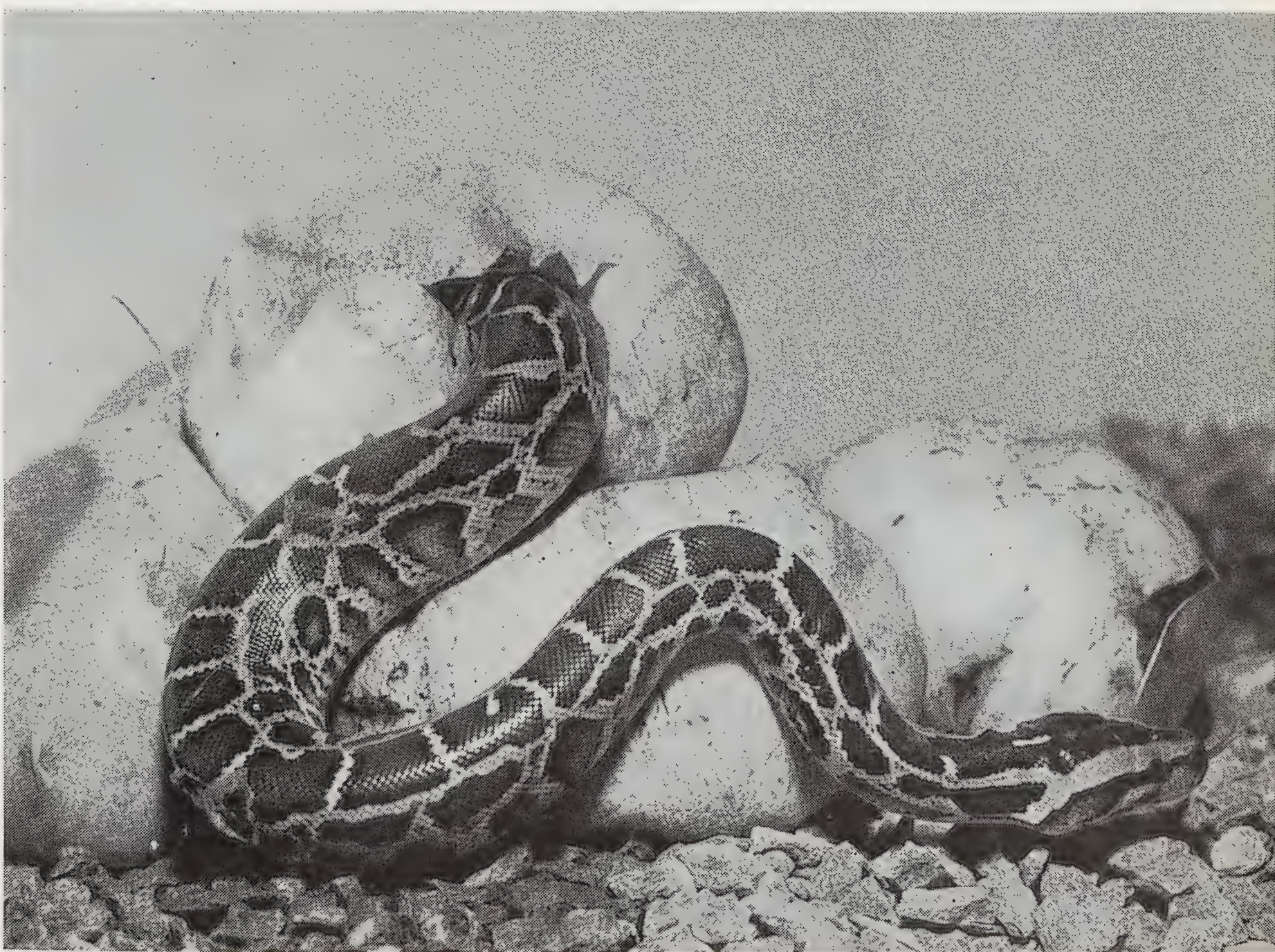
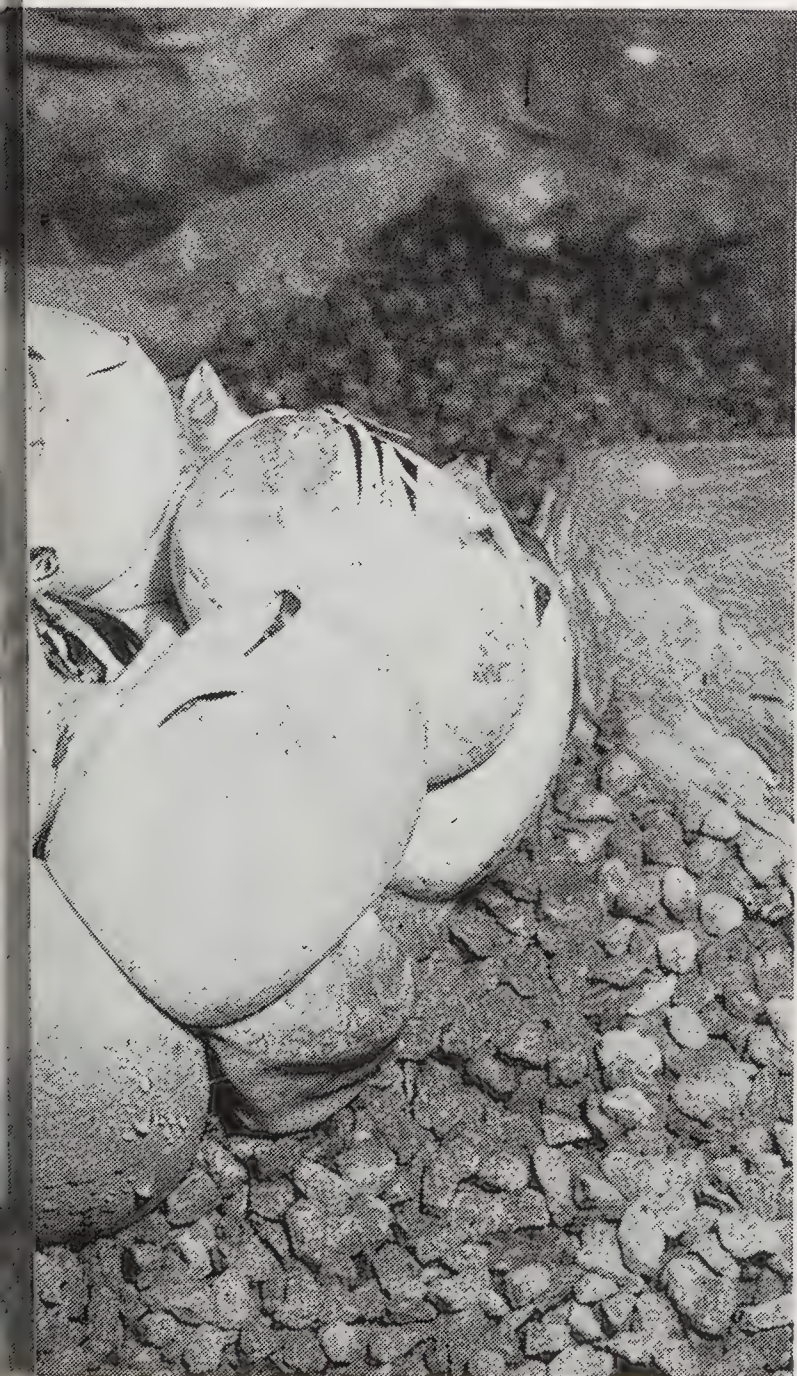
A PLETHORA OF CUBS

Three Jaguar cubs born on April 11 are not properly cared for by the mother, and so they have been reared by Mrs. Helen Martini in her home (it) and in our Animal Nursery. They are growing fast and will be on exhibition as soon as room is available. Mrs. Martini has had a busy few weeks, for she is also raising a baby Tiger born on May 7.



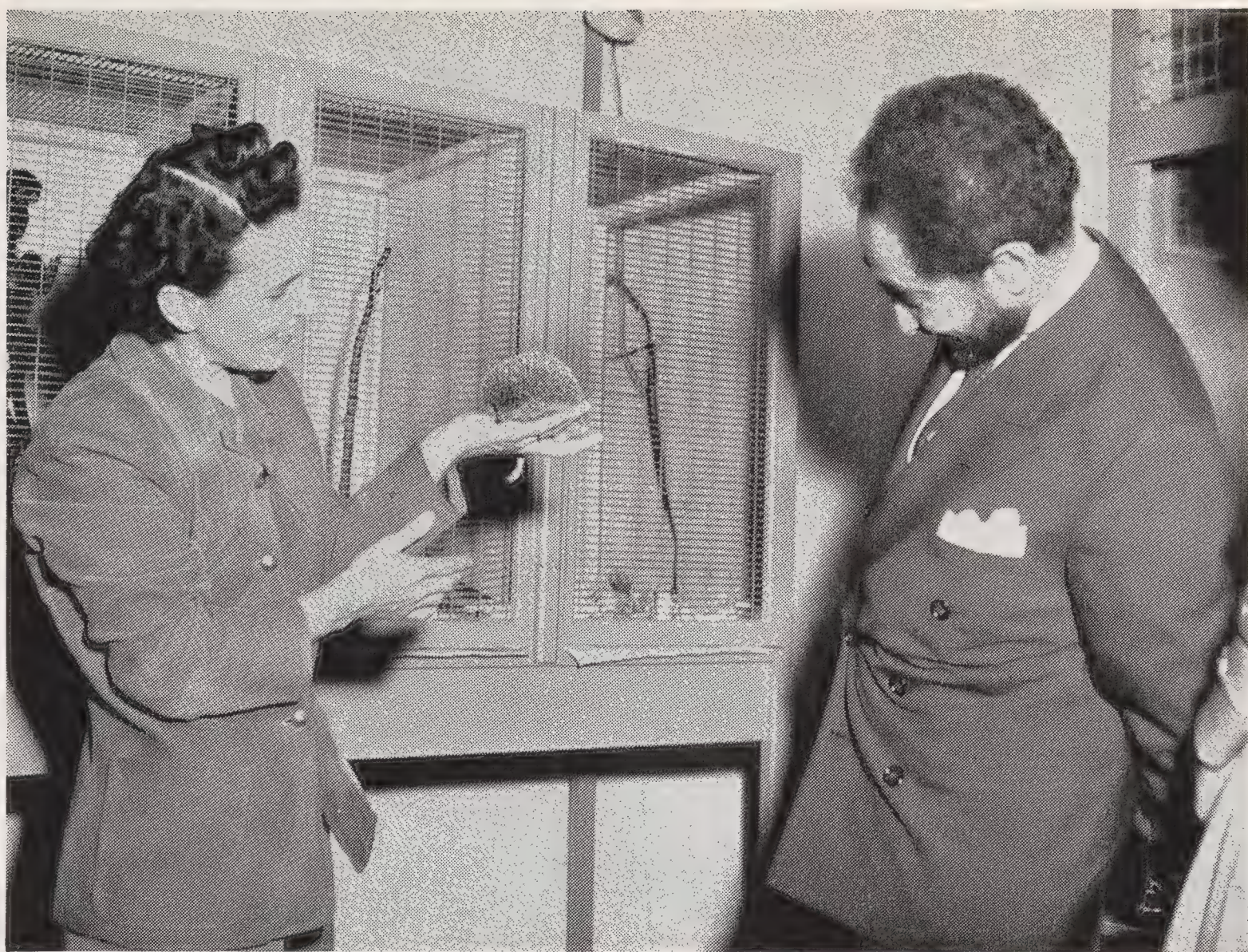
ENTER BELOW — Hatching of the clutch of thirty eggs began on June 18 and ended on June 21. Only a few of the eggs hatched, but during those three days the snakes poked their heads out in all directions. The female uncoiled when hatching started.

LOWER RIGHT — One of the two-foot youngsters begins to emerge from the egg. Most of them stayed in the leathery shell for several hours after hatching began. Since emerging, they have been feeding well. Eventually most will be sent to other Zoos.



THE EMPEROR OF ETHIOPIA VISITS THE ZOO

Haile Selassie, Emperor of Ethiopia, paid a surprise visit to the Zoological Park on July 2. He made a complete tour of the Park, but reserved his warmest smiles for the Animal Nursery. Mrs. Martini showed him all her pets, including this Long-eared Hedgehog, a recent arrival from the Biblical Zoo in Jerusalem.



IT HAS A GOOD FOSTER MOTHER

Monkeys ordinarily make excellent parents, but the mother of this baby Wanderoo was so incompetent we had to take over. Now it has a home in the Animal Hospital as the special charge of Nurse Mary Murphy. The baby has been named "Kenneth." Nurse Murphy takes it home at night by subway.



DISCOVERED - The Nest & Egg of the Black-winged Bellbird

By WILLIAM BEEBE



Head of the Black-winged Bellbird, with its "mossy" wattles. (From an illustration in "Birds of British Guiana," by C. Chubb.)

SEVERAL THINGS IN LIFE I have desired to see beyond others: Wild pheasants in their homes in the Himalayas, a glimpse of life in the black depths of the sea, the beginning of the eruption of a volcano, and the nest of a bellbird.

By sheer good fortune the first three have been realized. For forty-five years, until now, the fourth has evaded me and, for that matter, all other ornithologists.

At the Department of Tropical Research station at Simla, in Trinidad, in late March we received word that the nest of a Black-winged Bellbird had been located. For five years we had had similar news, and vague reports had placed the nests in lofty bromeliads, in holes in tree trunks, even on the ground. But the birds were never in the vicinity, and the nests were non-existent. Hope never dies in these matters and we agreed to investigate this latest alleged nest.

Procnias averano carnobarba is the Trinidad bellbird. It was named by Cuvier 137 years ago,

the type coming from the island itself. Nothing has since been learned of its courtship, nest, eggs or nestlings. The same sub-species inhabits the forests of tropical British Guiana and parts of Venezuela, north Brazil and Colombia, in none of which countries is its nidification known. The same ignorance applies to the nesting of all four living species of bellbird.

The Black-winged or Mossy-throated Bellbird lacks the blue and purple of a Cotinga, or the orange-red of the Cock-of-the-Rock, or even the glaring white of the Guiana Bellbird, but the colors of both sexes are unusual and pleasing. The male has the forehead, crown and nape coffee-brown. Above and below the plumage is silvery gray, with black wings and white tail.

He has the bizarre badge of his family, comparable with the upright wattle of the White Bellbird, the feathered fan of the Cock-of-the-Rock and the amazing feathered canopy of the Umbrellabird. From his throat there depends, for no reason that we know, a tuft or bunch of elongate, stringlike, fleshy caruncles. They are not connected with any internal organ, they cannot be erected, they are black. They serve only to enhance our ignorance and to inspire the scientific name *carnobarba*, the bird with the fleshy beard.

The female is dark green above, with pale

shaft lines on the head and nape. The throat is gray. The abdomen and sides are green streaked with yellow, changing posteriorly to uniform sulphur-yellow on the under tail coverts.

In Trinidad, the voice of the male bellbird is often heard in the valleys of the northern range of mountains, near Simla, especially in the early months of the year. Up to the present time it has been little more than a wandering voice. Perhaps a static voice would be more accurate, for the male has a favorite perch and calls from the same tree day after day, and month after month. The various common names are almost all connected with the voice: Bellbird, Capucin, Cong, Campanero, Anvilbird. The latter name is the most appropriate, for the sound is that of a hammer striking upon an anvil. This is unlike

the note of the White Bellbird of British Guiana, which has a more sonorous, bell-like quality. The utterances of the Black-winged vary slightly, sounding like *Conk* or *Tong*, *Kuk* or *Crok*.

At two in the afternoon of March thirty-first I started in the car with Henry Fleming and John Matthews the guide. We drove north up the Blanchisseuse Road to the summit, and on to the twelfth milestone. At this point the Paria-Brasso-Seco Road branches off to the right and this we followed for several miles. The coastal mountains and valleys, covered with dense government forests, extended in a majestic panorama to the north. Along the road were many cacao trees with dependent red and yellow pods, alternating with jungle and occasional tall tree-ferns. The farther north and east we went, the wilder the



This tall tree in the Northern Range of Trinidad was the favorite calling place of the male.

This is the first nest ever discovered of the Black-winged or Mossy-throated Bellbird. It was found in Trinidad by Dr. Beebe on the afternoon of March 31.



forests, and we had frequent reports of peccaries, monkeys, labbas, guans and sparkling-necked pigeons.

Finally, after thirteen miles by car, we took to a steep, well-trodden path and climbed a twisting grade for some distance. Suddenly the *Conk!* of a bellbird sounded close overhead and continued as we climbed on. When the path degenerated into a narrow trail, we seemed to be directly beneath the bird. The sound came from high up in a lofty tree. From a small, side ravine both Henry and I caught sight of a bellbird as it changed perches between calls.

The notes, as usual, were of two kinds: loud, isolated, vocal explosions, alternating with a series of lower syllables, *tong-tong-tong-tong*, with a twangy tone. The following is a few minutes' record of the calls of this particular bird. The C stands for single Conks, the numeral for successive number of Tongs. The intervals between Conks varied from one to ten seconds; the Tongs averaged two and one-half to the second.

C,C,C,28. C,C,C,C,C,C,C,9. C,C,C,C,C,C,8. C,C,C,29. C,C,C,6. C,C,C,C.

It is generally thought, erroneously, that the single notes are uttered by the male and the series of Tongs only by the female bellbird.

We passed an area of newly cut timber, the land being cleared for planting, and continued on toward a small house, perched on the steep hillside.

Here the owner of the land, Frances Williams, joined us. From him and our guide I learned that this pair of bellbirds had nested in the same place for the past two years, that they reared two broods of two young each season, in February, March and April, and that the male called from the same high tree in which we had heard and seen him. Our guide had noticed a fledged young bird in the nest three days ago and the owner said that it had left the nest only yesterday, he having seen both parents and young.

We climbed down the steep slope, past cacao trees, and at last the nest was pointed out. The male stopped calling at the moment we reached the nest site, and did not begin again until we started on our return trip.

My first glimpse of the nest took me back thirty-six years and nearly four hundred miles to the southeast, to Kartabo, British Guiana, where I had found the nest of the Pompadour Cotinga, *Xipholena punicea*. Its nest was smaller and even more flimsy than the present one, but the same type of flat platform.

Members of the Cotingidae, the family to which the bellbird belongs, differ as much in nest architecture as in peculiarities of voice, feather pattern and color. *Attila* and *Tityra* nest in ready-made holes in the trunks of trees, *Pachyrhamphus* fashions a huge, hollow ball of vegetation, while *Xipholena* and *Procnias* are satis-

fied with a twig nest of the simplest construction, as fragile as that of a cuckoo or a dove.

Fifteen feet from the ground, the nest showed as an open-meshed, shallow platform of twigs. It was near the tip of a slanting cacao tree, partly hidden by the large, pendant leaves. Not until we held the nest branch in our hands did we see the female, but never a glimpse of the newly-flown nestling. Twice the female flew low overhead, once uttering her deep-voiced croak. We neither saw nor heard any bellbirds other than this pair. In fact, during the whole operation only two other species of birds came into view, a Frigatebird drifting high in air from the ocean, a few miles to the north, and eight Amazon parrots flying toward the west.

With the aid of a ladder, rope and saw we severed the branch and eased it gently down. A drop of two feet would have disintegrated the whole structure. It was cradled in the flat crotch of three small branches, and measured roughly five and a half inches in diameter by one and a half inches deep. The foundation was of about 25 slender, lichen-covered twigs, mostly branched in long-armed, Y-shapes. So consistently was this the case that it seemed evident that this shape was intentionally chosen, an instinctive selection because of their interlacing power. The nest could hardly have held together with straight twigs. The lining was an openwork network of some thirty finer, brown twigs, the majority of these too being bifurcated.

To complete circumstantial evidence of the ownership of the nest, there were entangled in the twigs three contour feathers and a secondary of the female bellbird.

An interesting bit of native lore was told us in good faith. Occasionally, dogs refuse to bark when they are hunting, thereby reducing their guiding qualities to nil. A certain cure is to behead a male bellbird, to dry it thoroughly over a fire, then, little by little, to comminute the head of the bird and mix it with the dog's food. In a non-specified length of time the dog will begin to bark lustily!

In line with our consistent policy of studying living, wild creatures rather than shooting them I have made no attempt to collect a bellbird in Arima Valley. The one exception came to us by accident. On January 22, 1950, a dead male bellbird was brought to us by Dr. Newcome Wright. It had flown about his estate house for several weeks, associating with some white pigeons. On the above date it was picked up dead, having flown into a wire, and was brought to me.

I skinned it and recorded the following data: It was a male in advanced breeding condition. Its measurements in millimeters were, length 290, extent 490, wing 157, tail 86, culmen 19, tarsus 27. The bill, feet, legs, barbels and the skin of the mouth and throat, both inside and out, were jet black. The throat was covered with a dense growth of short, black, downy feathers from among which arose the numerous, fleshy, string-like wattles.

The gizzard was distended with a single, whole, oval, green palm fruit, and a second was broken into large pieces. In British Guiana I found the White Bellbird feeding on similar fruit. The courtship, eggs and young of bellbirds still await discovery, and especially the developmental evolution of the strange barbels.

Stop Press News!

THE ABOVE ARTICLE was in type and about to be printed when I received an airmail letter and photographs of a second bellbird's nest from Dr. Wilbur G. Downs, Director of the Trinidad Regional Virus Laboratory of the Rockefeller Foundation, a substation of which is operating on the Zoological Society's estate of St. Pats.

In the course of his search for yellow fever and other viruses, Dr. Downs recently investi-

gated the Cumaca area, about eight miles due east of Simla.

On May 23rd of the present year, just 53 days after the discovery of our nest number one, a huntsman who was guiding Dr. Downs, informed him that he knew where there was a bellbird's nest. I continue in Dr. Downs' own words in his letter to me:

"This nest was located about fifty yards from



On May 23 this second nest, with a single egg, was found by Dr. Wilbur G. Downs in another part of Trinidad. The photo is by Dr. Downs.

the house of a man named Patron at Cumaca, about 20 feet up in a cacao tree. The first day I visited the area I saw both the female as she flew from the nest, and the male nearby. When I returned, a couple of days later, the female again flew from the nest.

"I took the nest and the single egg and made a series of photographs which are being sent to you, airmail. The egg had a fully developed embryo, which was removed. I shall be glad to send it to you.

"The same guide also showed me another bellbird's nest which had been used the season before. This nest was also about 20 feet up in a cacao tree, right at the edge of the Cumaca trace, where people daily passed within a few feet of the sitting bird."

In answer to a cable which I sent at once to Dr. Downs, asking for a description of the egg,

he replied: "Bellbird egg is light tan, mottled, especially on larger end, with brown. Measurements 40.3 x 28.4 mm."

For comparison with the photographs of nest number one, I have added one of Dr. Downs', showing the second nest and the egg.

Points of especial interest in this discovery of a second and third bellbirds' nests are, the identity of location, fifteen and twenty feet up a cacao tree, and the similarity of structural materials and characteristic flimsiness of the nest. The very number of component twigs appears to be about the same. Another striking feature is the restricted geographical distribution, for if we imagine an equilateral triangle with eight-mile sides, the apexes would be occupied respectively by Simla, Nest Number One, and Nests Two and Three. The date extends the breeding season through May. Also we learn that a single egg may sometimes be incubated. Finally, the egg itself represents the first to be recorded of any species of bellbird.

FOUR BABIES FROM ALASKA



By ROBERT M. McCLUNG

HARBOR SEALS AND BALD EAGLES, though once native to the New York area, are now rarely seen in these parts. They are so plentiful, however, in certain parts of Alaska, that they are sometimes looked upon in quite unfriendly fashion by natives of that vast territory, especially fishermen. Seals and eagles are both primarily fish-eaters and as such are inevitably considered as pests by commercial fishermen where they occur in any great numbers. At present Alaska pays a bounty on Harbor Seals

and one was paid on Bald Eagles until two years ago, when, happily, it was removed.

This being the case, it would seem to be a comparatively simple matter to get specimens of seals and eagles from Alaska for exhibition. Just recently we did receive two young male Alaskan Harbor Seals and two fledgling Bald Eagles, but it took months of planning and lengthy correspondence, as well as the time and effort of a number of people, before the animals were actually collected and transported to New York.

It all started last fall, when Dr. Oshin Agathon, a member of the New York Zoological Society and an enthusiastic explorer and naturalist, asked whether we would like him to try to get a couple of eagles for us on his trip to Alaska this spring. We told him that we certainly would like them. Our last Bald Eagle, donated to us in 1931, had just died in August of 1953, having been in the collection for 21 years and 11 months. This was a Southern Bald Eagle, collected on Little St. Simon's Island, Georgia — a handsome and striking bird but not as large as the northern form. We also indicated that we would be happy to get a young male Harbor Seal as a possible future mate for our two females. Dr. Agathon, who in recent years has made collecting for scientific institutions his hobby, said he would do his best. So the machinery was set in motion.

Early this spring a permit to take two young eagles was obtained from the U. S. Fish and Wildlife Service. Dr. Agathon then corresponded with friends in Alaska — fishermen and seal-hunters, both white and native Tlingits Indians — asking them to be on the lookout for paired Bald Eagles and nests. In preparation for his trip he chartered a boat and a light plane.

Early in May Dr. Agathon arrived in Yakutat, Alaska, his base of operations. There he was met by Mr. Hardy Trefzger, his friend and guide. Preliminary investigation by these two showed that the eagles were nesting later than usual this year. No accessible nests were found which had fledglings in them yet, so Dr. Agathon decided to try for seal pups first. I will let him tell the story in his own words:

"In Alaska, Harbor Seals are born in May or early June. They are plentiful among the ice

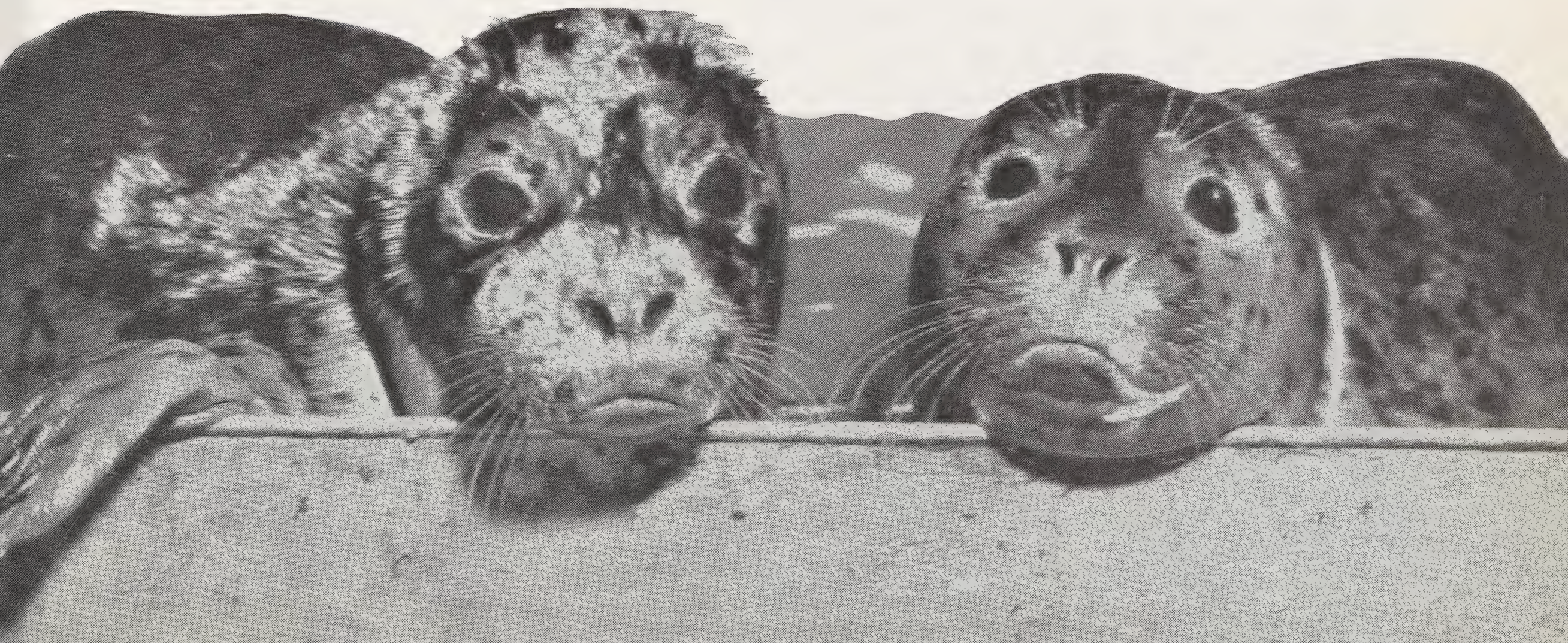
floes discharged by the tremendous Hubbard, Seward and Haenke glaciers into the icy bays of southeastern Alaska. There they are hunted extensively for the bounty; for their liver, which is considered a delicacy; for their skins, which are used for moccasins and other articles; and for their blubber, which either raw or rendered, is still eaten by a number of Indians.

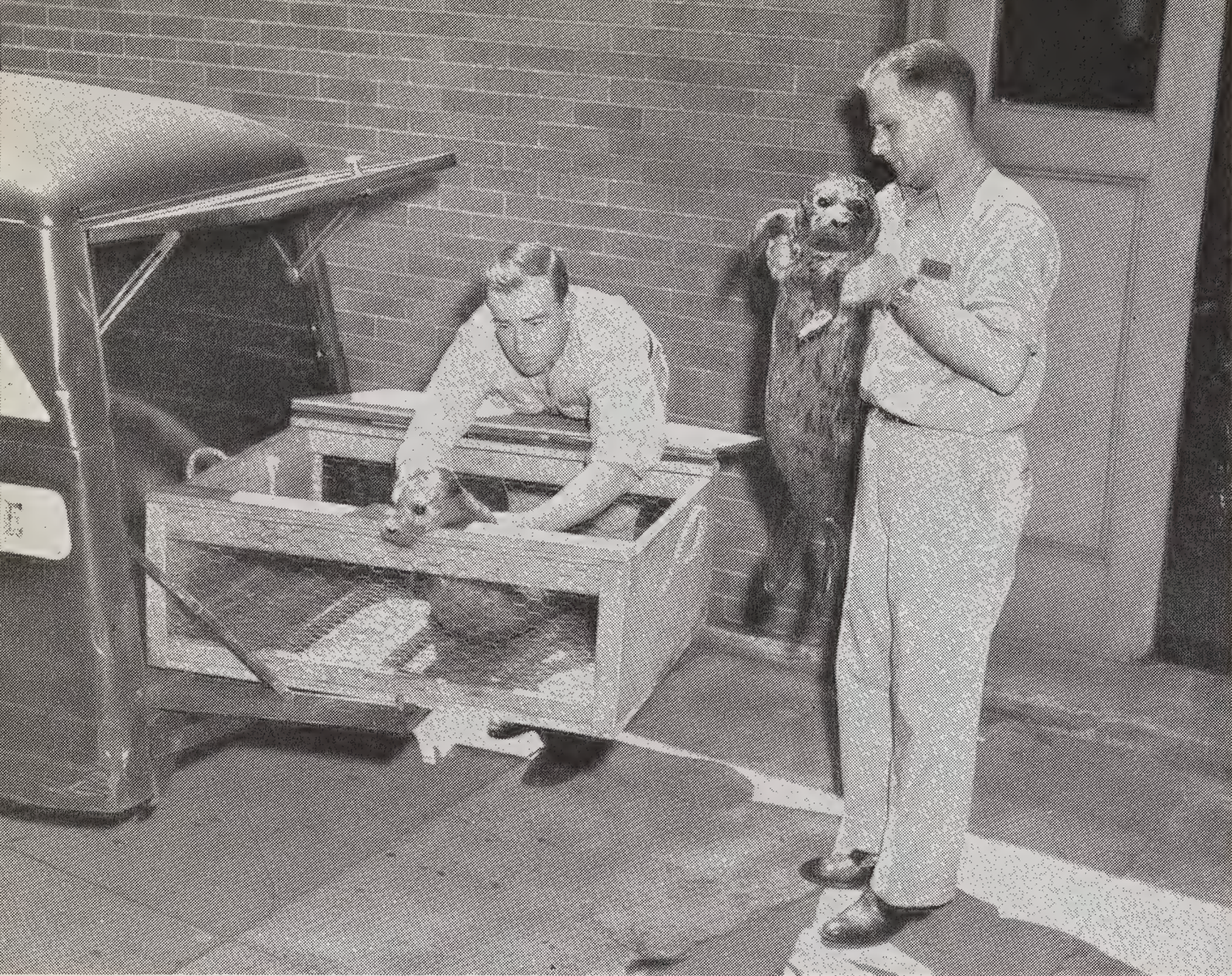
"The actual capturing of seal pups was delegated to Mr. Clem Simmons, a resourceful bush pilot and fisherman, and his two helpers who were seal-hunting at Icy Bay, a seal breeding ground about 70 miles north of Yakutat.

"The seal hunters first failed when they tried to stalk seals resting ashore. Seals have good eyesight and do not stray far from the relative security of the water. They have been hunted so extensively that they are difficult to approach. The hunters then resorted to a much more hazardous method, hunting through the ice floes in a light boat. Hidden by jutting blocks of ice, they sneaked up with heavy nets to the bergs on which they had spotted young seals which their mothers had left alone on the ice while they hunted briefly for food.

"It was a tricky business. Some of these floes are small and unstable. More often than not, by the time the hunters could throw their nets, the seal pups would have disappeared into the water. If the mother seal also happened to be on the ice with her youngster, she would push it into the water, or it would quickly follow her as she dove. Young Harbor Seals are able to swim very soon after their birth.

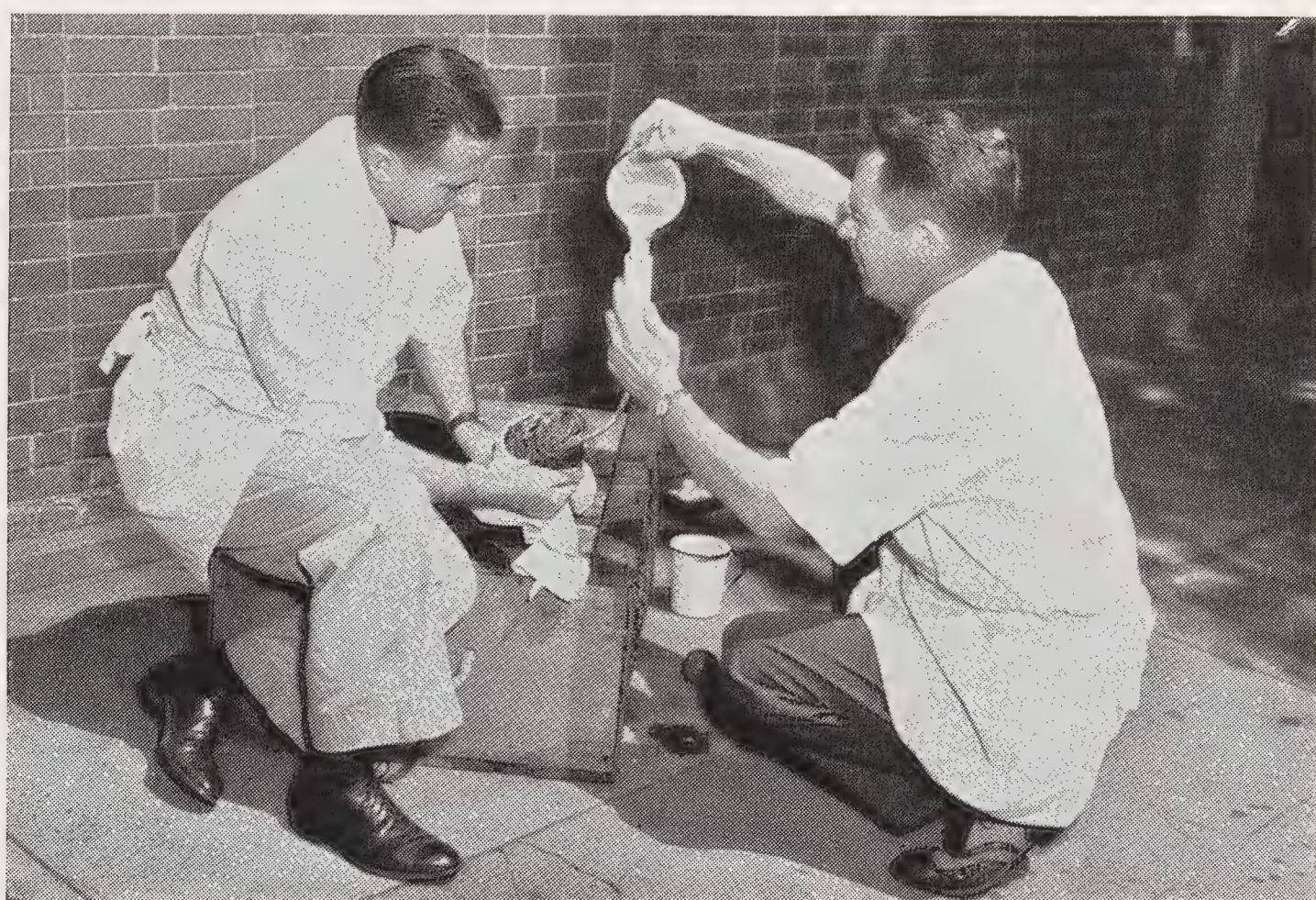
"The trappers were finally successful in capturing three young seal pups, all about a week old. These were flown back to Yakutat, and the





In this screened shipping crate the Harbor Seals were delivered to the Zoo at the end of their comfortable flight from Alaska.

They were too young to know how to eat fish and both seals had to be fed on a mixture of fish and oil administered by tube.



problem of feeding them commenced. Analysis of seal milk indicates a very high fat content, and zoo personnel had suggested a mixture consisting of six parts of evaporated milk, three parts of vegetable oil, and one part cod liver oil. The seal pups refused to nurse from a bottle, so Clem Simmons and his assistants took a heroic step. First they filled their mouths with the lukewarm mixture, then opening the pups' mouths, they blew the liquid into them. This did not work too well, as can be imagined. Simmons then decided to try force-feeding with a thin rubber tube. With this, he was able to blow the liquid into the young seals' stomachs, but not without a major struggle on the part of all participants.

"It was later decided to train them to take a nursing bottle, but a single feeding in that way

seemed to be more of a hardship on the animals than the force-feeding, for it took two and one-half hours to get them to drink approximately eight ounces of the oily mixture, which they were fed three times a day. They readily adopted their foster parents and followed them, crying 'maw' like a child."

Two of these youngsters finally made the trip from Yakutat to New York. Extensive arrangements had been made with the airline to insure their safe arrival in the quickest time possible, and when they finally arrived at the Zoo on the afternoon of June 4 they seemed in reasonably good shape after their long trip.

For the next several weeks they were housed at the Zoo Hospital. Weighing 19 and 22 pounds upon arrival, when they were approximately two-

and-a-half or three weeks old, they have progressed fairly well. Even yet we have been unable to get them to suckle successfully from a bottle, though many different methods have been tried. Tube feeding has been found easiest and quickest — a matter of minutes. We hope to be able to wean them to eating fish soon, and then they will be introduced to the two female Harbor Seals in our outside pool. It should be noted that these Alaskan pups are the form known as the Pacific Harbor Seal (*Phoca vitulina richardii*), while the two females are a European (*Phoca vitulina vitulina*) and a California Harbor Seal (*Phoca vitulina geronimensis*), respectively.

With the seal venture safely concluded, Dr. Agathon set to work with energy to get the young eagles. The very late spring of 1954 in Alaska complicated matters. Several accessible nests were spotted during trips to Russell Fjord and Disenchantment Bay in late May, but these had only eggs and no young ones, although at this time of year eaglets are usually hatched out and growing daily at an amazing rate. Dr. Agathon was anxious to bring back young birds in good condition, not too young and not too old. If too young, they might not have survived the trip to New York; if too old, it would be harder to adapt them to captive conditions. The following account of the locating of the nest and taking the young are again in Dr. Agathon's own words:

"Returning after two weeks to Yakutat and the alluvial flats of Dry Bay, we scouted by plane for nests. The nest which had been selected last year because of its accessibility unfortunately was deserted this year. The nearest convenient nest on a rocky, wooded promontory in the middle of the flats was in the top of a century-old and very tall cottonwood tree. Just to reach the base of that nest through the jungle of tall salmon berries and fiendish devil's club required quite a bit of trail blazing. It was impossible to climb the tree. A forty-foot ladder would have to be built. From a fisherman's hut fifteen miles away, a twenty-foot section was obtained and carried by jeep to the vicinity of the cottonwood trees. This proved too short; so the men spent many hours beach-combing the nearby Pacific shores for suitable driftwood, 2 x 4's, to make the additional length required. Finally, the forty-foot ladder was completed.

"Pushing it up the tree was no easy undertaking, for it required the clearing of a large space, and even then it fell short of the lowest limb from which a man could climb. At this time they still did not know whether eggs or young birds would be found in the nest, but most anxious to find out, they applied the ladder against a shorter nearby tree which Hardy Trefzger then climbed and from which he could see the interior of the nest, in which he reported two fine white eggs — as yet no birds. The ladder was left against the tree and the nest left undisturbed for about a week, although once in a while one of the three or four men in the party would sneak up the tree and peek into the one on which the nest was built.

"On Friday, June 11, 1954, the news finally came down: the eaglets were hatched — a cause for celebration! All agreed that it would be best to leave the young birds under their parents' care as long as possible, and I left that section for other work. On Saturday, June 19, my three good friends and assistants, to whom I give full credit for the success of this venture, namely, Hardy Trefzger, Clem Simmons, and Jake Mollan, shifted the ladder to a new position on the tree with the nest, and Clem Simmons was able to reach the lowest limb with a rope and to pull himself up and then climb to the nest. There, he picked up the two young birds, and with the help of a large handkerchief and a light nylon rope, he lowered them gently to his acolytes on the ground. That same day he flew Hardy Trefzger and the young birds to Yakutat where they were received with the enthusiasm one can imagine on my part. I immediately set about feeding them on what I thought from previous experience would be a good diet, namely, boiled large sea gull eggs (collected by the natives for food), fresh hamburger, and fresh salmon—all mashed together and slightly moistened. As distinguished from the baby seals which had to be force-fed with a rubber tube, the baby birds took readily to their new foster parent and the food I gave them. After a little coaxing they readily grabbed the food offered, showing no fear and no apparent resentment of the careful and friendly handling they received. In fact they became perfectly tame in a matter of days."

The birds were accompanied by Dr. Agathon

on the plane trip to New York. At each stop he fed them. It was a blazing hot day when Zoo personnel met the eaglets at the airport, and they obviously were not liking the heat.

However, they have adapted and are doing well at present, taking fish, meat and mice readily.

When we received them, they were just about fourteen days old, still in their gray, woolly natal

down with pinfeathers just sprouting. They weighed 4 pounds, 14 ounces, and 5 pounds, 8 ounces, respectively. Two weeks later they were rapidly assuming their dark juvenile plumage. By the time they are ten weeks old, they should be slightly heavier than their parents, and have a wingspread of approximately seven feet. They will not assume the white head and tail of their adult plumage until their sixth year.

News from the Conservation Foundation

Model State Conservation Law Available

Demand for copies of "A Model State Conservation Law" which appeared as an appendix to the Foundation's study, "Conservation Law and Administration in Pennsylvania," written by Professor Schulz of the University of Pittsburgh Law School, has caused the Foundation to have the Model Law reprinted as a separate pamphlet. Copies of these reprints are available in bulk at 20¢ per copy for 25 or more copies.

Soil Erosion Survey Completed

Detailed colored maps illustrating the extent of soil erosion in Central and South America have been completed after three years of study as a joint project of the Conservation Foundation and the U.N. Food and Agriculture Organization. These maps will appear along with a text describing the several categories of erosion and interpreting their significance in forthcoming issues of *The Journal of Soil and Water Conservation*. Reprints of the maps and text will be available from the Foundation later this summer.

Progress on Jamaica Study

Peter Stern of the staff of the Research Division has recently returned from a geographical survey of Jamaica. His findings will be used in rounding out factors of resource production and economic needs in connection with the overall Study of Family Life in Jamaica which should be concluded this fall.

"The Making of a River"

The Foundation's new film, *The Making of a River*, will be distributed by Coronet Films, Inc. A preview of this film before completion and integration of the original musical score was offered at the Society's Annual Meeting last January. It is hoped that this film will also be shown commercially in the fine arts theaters throughout the country.

Rome Conference on Population

Robert Snider, the Foundation's Director of Research, has been authorized to represent the Foundation at the forthcoming International Conference on Population to be held at Rome in September. Mr. Snider will also participate in the meeting of the International Union for Protection of Nature in Copenhagen in August.

Participation in Wildlife Studies

The Conservation Foundation will participate with the Zoological Society in sponsoring two important wildlife studies. A study of Bighorn Sheep will be conducted by Dr. Helmut Buechner of Washington State College and a study of the Influence of the Prairie Dog on Prairie Ecology will be conducted by Dr. Karl Koford, presently of the University of California, in collaboration with Dr. Raymond Hall of the University of Kansas. Dr. Koford will become a research associate of the University of Kansas for the duration of this study.

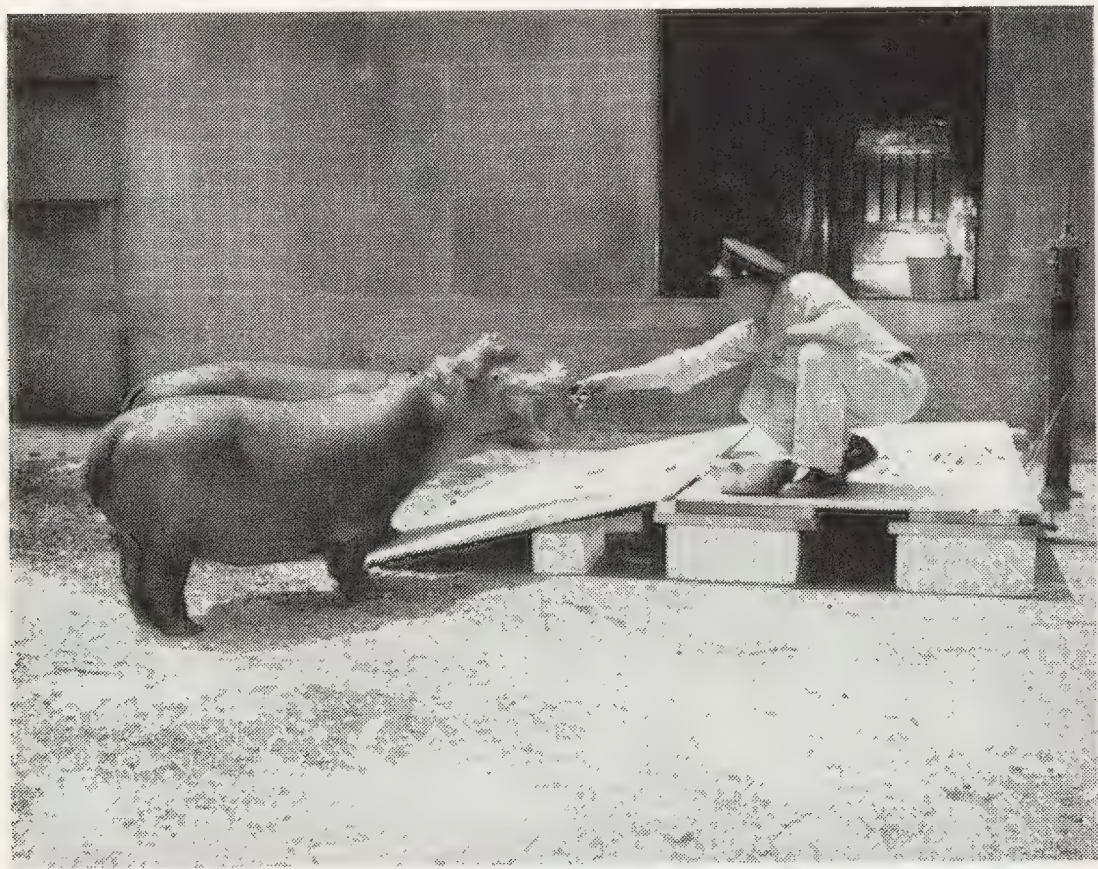
BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Peter the Second Officially Is Two Years Old

Unless an animal is born in our collection or in some other zoological park it is usually impossible to establish the exact date of birth. We were fortunate in knowing the whole history of Old Pete, our Hippopotamus, which died on February 1, 1953, at the known age of 49 years, 6 months and 19 days. About his successor, Peter the Second, or "Little Pete," we cannot be so sure, although when he arrived in the summer of 1953 we estimated his age as "about" one year.

In honor of Old Pete, whose birthday was July 13, we have arbitrarily chosen that date as Little Pete's anniversary, to be suitably celebrated



Pete's "official" birthday party

if he eventually begins to approach the advanced years of his predecessor. Little Pete is not as tractable as Old Pete, as we found on July 13 when we tried to weigh him without forcing him into a crate—a procedure he strongly resents. We had no luck at all.

Dacca's Cubs Doing Well

One of the best shows in the Zoological Park at present is provided by Dacca, our Tiger mother, and the two cubs that remained with her after their birth on May 8. The two little males have

been named Mota and Kala. A third cub, too weak to be left with its mother, was reared by Mrs. Helen Martini and has been named Fer. It will be reunited with its brothers in about a month, after Dacca weans Mota and Kala.

Early-Morning Donations

Several times in recent months our Curator of Reptiles has been stopped by the gateman at the Service Gate of the Zoological Park with the report that "You just missed him." "Him" turned out to be John H. Phipps, a Trustee of the Zoological Society, who had paid a hurried call to the Reptile House between 8 and 9 A.M. to leave a welcome collection of reptiles. We owe to his interest such specimens as Florida King Snakes, a large Florida Soft-shelled Turtle, a Pigmy Rattlesnake, Scarlet King Snakes, Corn Snakes and Water Snakes.

Aquarium Associate Gets Award

Dr. Homer W. Smith, Professor and Chairman of the Department of Physiology of New York University College of Medicine and a Research Associate in Physiology at the Aquarium since 1938, has been given the Passano Foundation Award of \$5,000 for his many contributions to knowledge of the physiology of the kidney. Many of his basic experiments on kidney function in fishes were performed at the old Aquarium at the Battery.

Fairy Bass at Aquarium for First Time

Two specimens of the Fairy Bass, *Gramma hemichrysos*, are now on exhibition in the Aquarium through the courtesy and efforts of Frank Trevor of the Millbrook School and Roswell Miller of Millbrook, N. Y. These small but brilliantly colored marine fish are found in the West Indies and Bermuda, and although abundant in local areas are very difficult to capture.

Ours were taken on the reefs around Rose Island near Nassau in the Bahamas, and are apparently the first ever exhibited in the United States. — J.W.A.

Dr. Gordon In Brazil

Dr. Myron Gordon, the Aquarium's Geneticist, is attending the Sixth International Cancer Congress in Sao Paulo, Brazil. He is presenting a paper based on work in our Genetics Laboratory.

It's the Same Fish

When most fishes hatch from the egg, they do not at all resemble their parents. Besides being extremely small, they are in an undeveloped state, with fins and scales that are poorly formed or absent altogether and with little or no pigmentation except in the eyes. In addition, they are burdened with a large yolk sac which hangs underneath them and is frequently so heavy that it keeps them from moving about. This state of affairs is well known to scientists, who call such baby fishes *larvae*.

Spectacular changes must occur before these larvae assume the form of the adult fish, but once the yolk sac has been absorbed and the fins, scales and pigmentation have developed, the little fish remains pretty much the same in overall appearance for the rest of its life.

An unusual exception to this generality has been brought to our attention by our Giant Gouramis, *Osphronemus goramy*. The changes that our large specimen underwent while growing up were so striking that we suspected there might be something abnormal about the fish. The tre-

mendous enlargement of its lower jaw, as well as other less prominent alterations, gave to it an almost entirely new appearance.

The Giant Gourami is an important food fish in the tropical Far East, and so we made a point of showing our large specimen to some East Indian fish culturists on a visit to New York. They assured us that our Gourami was a perfectly normal individual and that young and adult Gouramis do indeed at first glance look like different species. — J.W.A.

Can You Spare a Back Number?

Quite a number of back issues of the Zoological Society's BULLETIN and ANIMAL KINGDOM are out of print or in very low supply. We have many requests for them from libraries and individuals and if any of our Members can contribute any of these issues, they may be sure they will be put to good use.

BULLETIN

1914. Vol. 17, No. 1
1917. Vol. 20, Nos. 2, 3 and 4
1920. Vol. 23, No. 6
1925. Vol. 28, No. 6
1926. Vol. 29, Nos. 4 and 6
1938. Vol. 41, No. 4
1940. Vol. 43, No. 4
1941. Vol. 44, No. 4

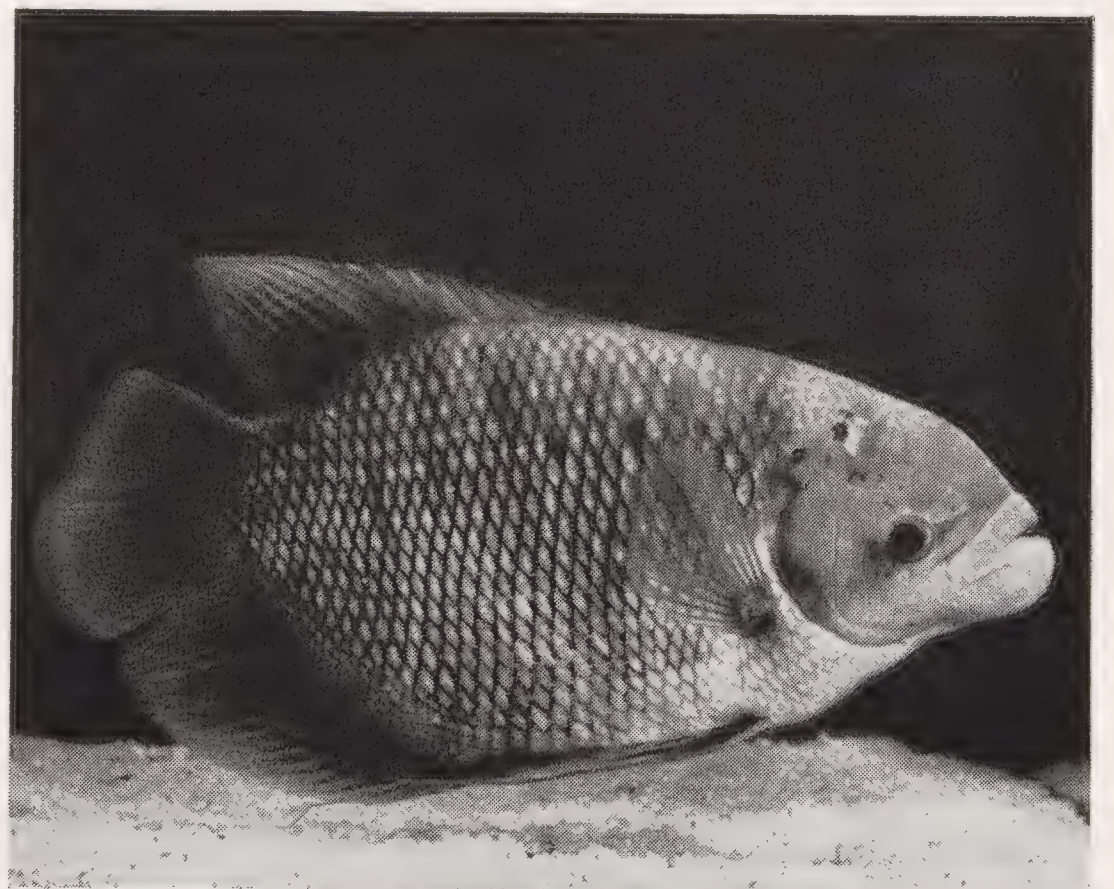
ANIMAL KINGDOM

1942. Vol. 45, No. 1
1944. Vol. 47, No. 4
1945. Vol. 48, No. 6
1947. Vol. 50, No. 3
1952. Vol. 55, No. 1

Any or all of the above will be gratefully received at the Publications Office, the Zoological Park, New York 60, N. Y.



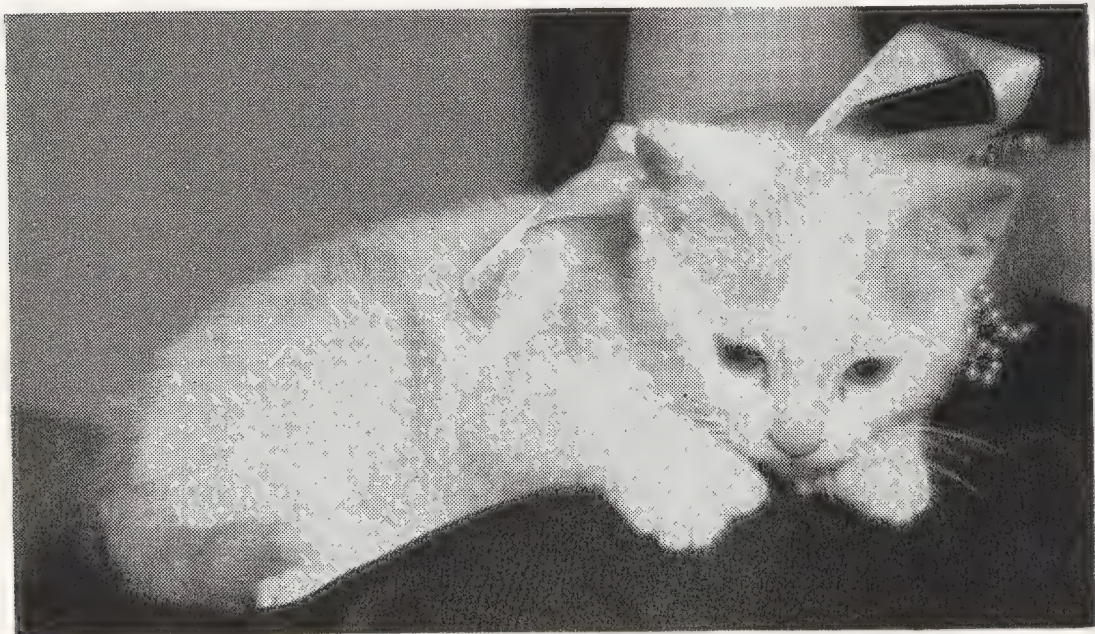
A juvenile Giant Gourami



An adult Giant Gourami

Children's Zoo Kitten Made Her Last Days Happier

For several years our Education Department has been taking pet animals to the children's section of Memorial Hospital, where most of the patients are suffering from some form of cancer. Early this summer a special request came through for a visit in advance of the regular time. A 7½-year-old girl was near death from leukemia and for her "seven-and-a-half birthday" she had asked for a kitten.



Mrs. Ruth Gruber took a kitten from the Children's Zoo, a rabbit and a guinea pig to the hospital that same afternoon and the child was entranced; she had no interest in the rabbit and the guinea pig, but the kitten brought the first smile to her face in several days. Mrs. Gruber was told privately that the end was very near, and so on the following two days she returned with the kitten. On Friday Staff Photographer Dunton made a quick photograph of the kitten, with a ribbon around its neck, and this was left with the child Friday night. She died Monday morning with the picture beside her.

Zoological Park Miscellany

A pair of Black Lemurs (*Lemur macaco* Linnaeus) received from northwestern Madagascar in late July are the first of their kind we have had in 24 years. They will be exhibited in the Small Mammal House. Males are black, but females may be brown or reddish-brown; ours is brown. The male is peculiar in having one brown eye and one yellow eye . . . A baby Euro Kangaroo is in its mother's pouch in the Kangaroo House. It was first seen putting its head out on July 13 . . . Axel Reventlow, Director of the Copenhagen Zoo, has sent us a welcome collec-

tion of shore birds, including four European Avocets, four Oystercatchers, four Ruffs, a Ringed Plover and a European Redshanks . . . From Chief Steward Robert Ball of the M/V *Sobo* the Aquarium has received a number of Mudskippers collected on the west coast of Africa. Because they spend so much time out of water, a special tank with a generous amount of "beach" has been set up for these fish . . . An interesting new arrival in the Bird Department is a Sickie-winged Guan, *Chanaepetes goudotii* ssp., found in Ecuador, Peru and Colombia. It is the first of its kind we have ever exhibited . . . In July we sent our third shipment of North American reptiles to the Biblical Zoo in Jerusalem, in an exchange arrangement whereby that institution sends us desert reptiles from the Palestine region.

PUBLICATIONS OF INTEREST

New Naturalist Monographs. Published by Collins, St. James Place, London. Distributed in the United States by John de Graff, Inc., 64 W. 23rd St., N. Y.

The Yellow Wagtail. By Stuart Smith. With 26 colored illustrations by Edward Bradbury, 11 photographs in black and white, 4 line drawings and 4 maps. Pages 178 + XIV. 1950. Price \$2.50.

The first publication devoted to a single species of bird, of a projected series on British fauna. All that could be said of the familiar Yellow Wagtail appears to be included in chapters detailing distribution, migration, territory, display, breeding and systematics. A lengthy bibliography and an excellent index complete a most useful little volume.

The Redstart. By John Buxton. With 20 photographs (1 in color by Eric Hosking), 20 maps and diagrams and 2 text-figures. Pages 180 + XII. 1950. Price \$2.50.

Five years as a war prisoner in Germany gave the author opportunity for amassing much of the detailed information set forth in this monograph. The subject, of course, is the British Redstart, a relative of the thrushes and not the American warbler of the same name. In the general format that presumably has been devised for the series, subjects covered include territory, nesting, migration, history and distribution, with a summary of related species. Bibliography and index again round out an excellent work.

The Fulmar. By James Fisher. An illustration in color by Peter Scott, 82 photographs (4 in color), 70 maps, drawings and diagrams. Pages 496 + XV. 1952. Price \$8.00.

Unlike the preceding monographs in this series, this impressive volume presents a study of distribution and population rather than complete life-history. Certainly it will not become popular as light reading but as a source of material for future workers, it will prove invaluable. Oceanic birds in general offer many problems in breeding distribution and seldom indeed has any species been so thoroughly run down. More than 500 collaborators have aided the author with their observations, actually making the compilation possible. Mr. Fisher is to be congratulated on the successful completion of a task to which he has devoted years of work and study. — L.S.C.

ERNEST THOMPSON SETON'S AMERICA. Edited by Farida A. Wiley, with a contribution by Julia M. Seton. Illustrated by reproductions of drawings by Seton, in black and white. Pp. 413 + xxiii. The Devin-Adair Co., New York, 1954. \$5.00.

Those who were privileged to know Ernest Thompson Seton will remember best the vibrant, outgoing quality of his personality. He had much to give and giving was his greatest pleasure. Gifted in the use of both pen and brush, his consuming interest in both people and animals found abundant expression. Miss Wiley's selections from Seton's voluminous works have been excellently chosen and probably each chapter represents the finest in its particular field. But many present day naturalists—shall we say of the older school?—will still thrill most pleasantly to the tales of "Lobo" and "Krag."—L.S.C.

KEEPING AND BREEDING AQUARIUM FISHES. By C. W. Emmens. 202 pp., illus. Academic Press Inc., New York, 1953. \$4.50.

It has long been obvious that a book devoted to the principles as well as the practices of home aquarium keeping was in order. Here is such a book, and by a Professor of Veterinary Physiology who is one of the leading amateur aquarists in Australia. The book lives up to high expectations in most regards, giving a comprehensive and clear account of the *hows* and *whys* of aquarium maintenance. It is, however, marred by a score or more of minor errors. These mistakes mostly

concern remarks about the fishes themselves and, surprisingly enough, the diseases of fishes. It is too bad Dr. Emmens did not have some ichthyologist check his manuscript.—J.W.A.

THE LIVES OF WILD BIRDS. By Aretas A. Saunders. Illustrated by 22 drawings in black and white by Dominick D'Ostilio. Pp. 256. Doubleday & Co., Garden City, New York, 1954. \$3.50.

In this small volume, Mr. Saunders provides a guide for the "bird watcher" who would like to put his observations to further use. After brief but helpful information on identifying birds in the field by color, size, shape, habit and song, he proceeds to the proper keeping of notes and the watching of migrations. Under "The Nesting Cycle" comes the real gist of the book, covering territory, courtship, behavior, plumages and kindred subjects, all fields in which the serious bird student may make observations of real value. Mr. D'Ostilio's drawings add much to the attractiveness of the book.—L.S.C.

BUILDING AN AVIARY. By Carl Naether. 44 illustrations in black and white, from photographs and line drawings. Pp. 85. All-Pets Books, Inc., Fond du Lac, Wis., 1954. \$2.25.

The building of an aviary is a matter so specialized that full and detailed instructions—or suggestions—are difficult to come by. Professor Naether has covered the field thoroughly well, chiefly in the interests of the private aviculturist, and his efforts will serve a definite and useful purpose.—L.S.C.

New Members of the New York Zoological Society

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ANIMAL KINGDOM

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Vol. LVII OCTOBER 1954 No. 5

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Odyssey of Money

This is the third of a series of brief editorials to illustrate the fruitful ways in which money given to our Society can be used.

OCCASIONALLY the use of moderate amounts of money will start things which, as in the song of the great river, "just keep rolling along." One has a good feeling when this happens.

In the last few years our Society has used some of its funds to initiate enterprises or programs which, having established their value, are now being carried on by others. Two such examples are the Field Research Station and the Wildlife Park in Jackson Hole, Wyoming. Both of these projects have proved successful and from now on their administration and costs of operation will be assumed by the University of Wyoming and the National Park Service respectively.

Another example is the impetus given by our Society to the establishment of a course in Marine Ecology at the famed Woods Hole Biological Laboratory. For a great many years that Laboratory has done outstanding work, particularly in the field of the physiology of marine creatures — work in which several of our own staff have participated. Trained as many members of our staff are in the broad, as well as the specific, aspects of animal life, they became conscious of a trend toward over-specialization at the Woods Hole Laboratory and felt that it would be valuable to the physiologists, in particular, to know more about the actual life of the animals which they were using as material in their investigations. Consequently we perceived a chance of encouraging a movement "out of the laboratory" and "into the ocean." The administration at Woods Hole warmly welcomed the idea of a new course which would contribute to a better understanding of living animals themselves. Our Society provided the funds for the establishment of the course which has aroused such interest that the Laboratory will carry it on from here.

Activities such as the above — and many others could be mentioned — reflect the purposes which our institution is destined to accomplish. Our *design room* is filled with plans awaiting the day when we have the resources to carry them out.

Fairfield Osborn



The Well-armed PORCUPINE

By ALBERT R. SHADLE

Biology Department, University of Buffalo

WALKING THROUGH our leafless northern forests on a sunny day in winter, it is not uncommon to see, high up on a limb, a large, dark-colored, roundish or oval object sitting so quietly that it looks almost like a growth on the tree. The mass appears so uniform in shape and color that one must get fairly near to it or must use a pair of binoculars to distinguish its characteristics and find that it is a porcupine sitting hunched up, sunning itself.

Although it is well protected by its heavy hair coat interspersed with many thousands of sharp-pointed, greatly modified hairs called quills, the porcupine is a pacifist and does not go about looking for trouble. It never provokes a fight with another animal but it is always ready to take care of itself when disturbed or attacked. People are usually afraid of it and say they do not want to get close to a porcupine "because it shoots its quills at you." That silly "old wives' tale" has no factual foundation. A porcupine cannot shoot its quills at you any more than you can shoot your hair at it. All mammals shed their hairs from time to time and when a dog is shedding or molting many of the loose hairs fly off into the air when the dog shakes himself. When a porcupine's hairs and quills are disarranged and feel uncomfortable, the animal gives its whole body a vigorous shake to rearrange its coat or pelage to the normal, more comfortable position. At molting time, loose quills are occasionally dislodged by such vigorous shaking of the body and one or more quills may fly out a distance of two to four

feet. These dislodged quills are so light and have so little momentum that even if they did strike a person they would fall harmlessly to the ground, because they would not have the force to penetrate either the clothes or the skin of a man.

In its natural surroundings, the porcupine is a timid, retiring animal and since its eyesight is not very good, except for moving objects, it depends to some extent upon its hearing, its sense of smell and, to a large extent, on its keen sense of touch to warn it of approaching danger. When a man is standing perfectly still by a woodland trail, a porcupine on the trail may walk directly up to him without being aware of the man's presence, and may finally wander on slowly through the woods.

The porcupine is a blunt-headed, heavy-bodied, muscular animal with a short, heavy, club-like tail. All four feet bear long heavy claws which are used mainly in climbing and holding on to objects. On the ground, when undisturbed, this animal moves with a slow, leisurely, waddling gait, but once disturbed it lopes off to climb the nearest tree or to seek the protection of a cavity or a crevice or to crawl under any available protection, such as projecting roots, a bush, a log or a rock.

The North American porcupines have a long history of occupation which extends back for a million years or more to the Pleistocene Period, in which they appear to have been well established in North America. The northern limit of

their present distribution extends from western and northern Alaska, across Canada to the eastern coast of Labrador. The southern boundary of the range extends from southern New England down through New York, Pennsylvania and West Virginia, west through Michigan, Wisconsin, Minnesota and North Dakota to about the United States-Canadian Border in central North Dakota. The western parts of North and South Dakota, Nebraska, Kansas, Oklahoma, Texas and all of the states west of this area are within the western range. The range also extends down a short distance into the states of Sonora and Chihuahua in northern Mexico.

According to the more recent literature, all of the North American porcupines belong to a single genus and species, *Erethizon dorsatum*, of which there are several subspecies. The coloration of the different individuals may be quite variable. The eastern, or so-called Canadian porcupines, have coats which vary from a black or grizzled black to a brownish color. The western forms show considerable yellowish tinge to the pelage and consequently are usually referred to as "the yellow-haired porcupines." These have a musky or smoky odor which is quite different from the odor of the eastern ones. Besides the great variation in color among the different individuals of the same subspecies, each individual may also show marked changes in coloration over a period of years. Porcupines are occasionally found in which there is complete lack of pigment in the pelage, claws and eyes. These albinos are white to cream colored, have pink claws, and since the iris lacks pigment, the color of the blood shows through it, giving the iris a pinkish tint.

Although the porcupines are generally associated with wooded areas, they may sometimes be found in low, bushy areas along streams and also in bushy dry areas if there are good den sites in the region.

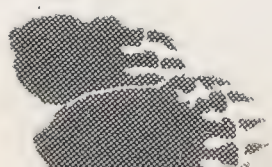
They do not hibernate in winter but continue to be active, for even in the worst winter weather their natural foods are available. They may remain in their dens for two or three days during very inclement weather but since they are able to withstand rigorous winter conditions, on milder days instead of returning to the dens after



Photo by Robert D. Weigel

feeding they sometimes remain for a number of days at a time in their favorite feeding spots, usually evergreen trees.

The porcupine makes no nest but dens in any dry cavity, such as a hollow tree, a cave, a crevice or a large rock pile. It may also den in or under an abandoned building. It frequently spends the day resting and sleeping but occasionally it may show some activity during the daylight hours, especially on cloudy days. When undisturbed by the presence of man, it is likely to begin its feeding and its general activity in the early evening and continue its nocturnal wanderings until daybreak or later. After its nocturnal activity, the porcupine often retires to its den in unpleasant weather but if the day is pleasant and sunny it may climb up into a tree and pass the whole day resting where it is exposed to the warm sunshine. Even during the warmer parts of the year it spends many of the daylight hours in a tree,





hunched up in a mass or sprawled upon or draped over one of the higher limbs, enjoying the sunshine and the cool breezes. By shallow rapid respiration and restive movements it exhibits heat distress when it has been exposed to direct sun at ground level or to high summer temperatures in the laboratory.

The pelage, i.e., the hairy covering of mammals, often shows more or less variation and adaptation of certain types of hairs which perform particular functions. While most mammals show only one or two such adaptations of the hairs, the North American porcupines show several very interesting hair modifications and special functions. The long tactile or guard hairs, the highly specialized quills, the general coat hairs and the ventral hairs are broadly and generously scattered over much of the body, while the "whiskers" or vibrissae, the terminal tail bristles and the ventral tail bristles are quite localized.

During the late fall and winter the general hair coat may almost completely hide the quills except when the porcupine is on the defensive

hairs, is very sensitive when touched. These guard hairs are not only found in this "cape" area but are sparsely scattered over most of the exposed surfaces of the body and along the legs and feet. When touched, these guard hairs aid in alerting the porcupine to the presence of another animal, thus serving as means of defense. A second type consists of the long general coat hairs which are much more numerous but somewhat shorter and finer than the guard hairs. The general coat hairs are distributed more or less over the remainder of the back, behind the "cape" area, as well as on the sides of the body and the top of the tail. They are least numerous in the "rosette" area. These long coat hairs together with a third type, a short, fine, closely-set, light-colored underfur, make up the bulk of the "cape" and provide the main protection from the elements and from the loss of body heat. The fourth type, the quills, are found hidden among the fine coat hairs. These sharp, stiff, spine-like struc-

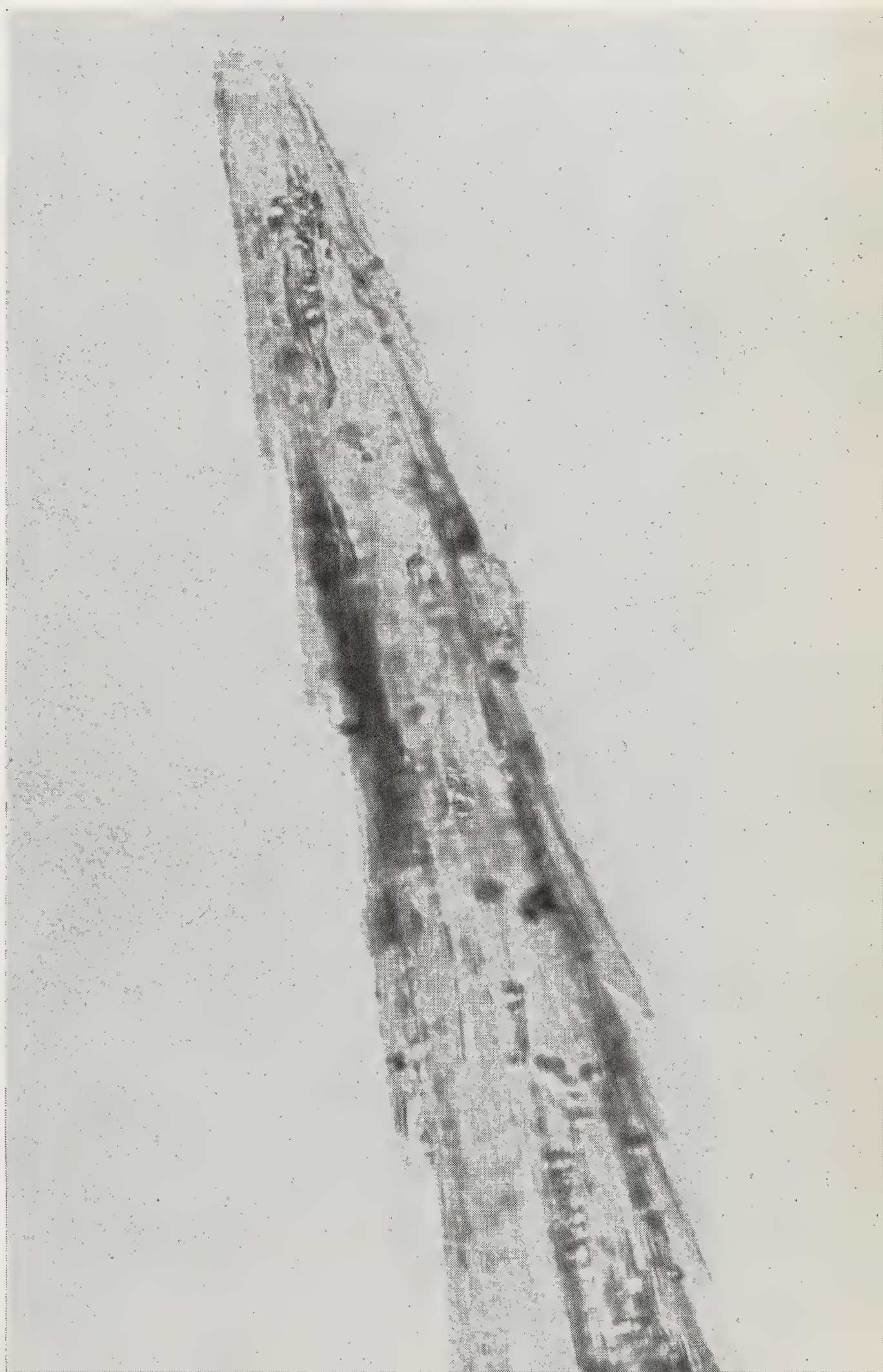
How thoroughly the quills guard a porcupine's body is well-demonstrated in this photograph of the animal as it investigates a blue spruce.

Photo by Robert D. Weigel

The "business end" of a porcupine quill, under the microscope, shows the minute scales. They enhance its power of working deeply into tissue.

and erects its quills. During the late spring and early summer months, while the new hair coat is growing in to replace the hairs which were shed, the new hairs may be so short and inconspicuous that the animal appears to be covered only with quills. After some weeks the new hair coat will again be long enough to partially or even completely conceal the quills.

In the winter the grizzly coat of the Canadian porcupine is longest over the crown of the head, the neck, the shoulders and on the anterior two-thirds of the back and sides. When the hairs and quills in this region are partially erected, this heavy coat looks almost like a short thick "cape." This "cape" area contains four main types of hairs of which one type, the long, wiry, tactile or guard



tures are really greatly modified hairs and are present in great numbers. They are not only found in the "cape" area but are distributed from the region in front of the eyes, along the top and sides of the head, of the neck, and of the body, to the tip of the tail. They function both defensively and offensively. The underside of the head, of the body and of the tail, the inner sides of the legs, the terminal part of the nose and the tip of the tail bear no quills.

Directly behind the "cape" is a large roundish or oval quill patch, the "rosette," which covers the lower back, the rump and the sides of the animal. This area alone may contain as many as five thousand strong quills varying in length from half an inch to three or more inches. It shows to the best advantage when the animal is disturbed and has erected its quills, whose sharp points extend out in every direction and form an almost perfect protection for the rear end of the body. Although the "rosette" is one of the most effectively quilled areas, it is also the most scantily haired, large area on the porcupine.

The hairs on the underside of the head and of the body are much shorter and slightly larger in diameter than those which form the general hair coat described above. They protect the ventral surface of the animal and being somewhat stiff, they aid in climbing.

The long, stiff, black "whiskers" or vibrissae of the porcupine which are localized on the sides of the nose and on the face, are very highly specialized structures. They are very efficient in receiving touch stimuli at any time but they are especially valuable at night and in dark cavities. Stimulation of these touch or tactile structures enables the animal to sense the presence of an object, another animal, or a movement, even when the porcupine is asleep. These vibrissae are so important to this animal that it is never without them, even during the molting period.

The tough, stiff, bristle-like hairs on the underside of the tail are efficient aids in climbing and are not easily detached from the skin. In climbing a tree, the porcupine grasps the trunk with all four long-clawed feet, claps its tail tightly against the bark and hitches rapidly up the trunk. In doing this, it reaches up as high as possible on the tree trunk, takes hold with its fore feet and pulls its body and hind legs up as far as possible,

then clings to the tree with its hind feet and tail, while the fore feet again reach upwards to take a new hold higher up. By repeating these actions many times, it climbs rapidly up the tree. The strong heavy tail serves as an excellent prop or brace against the trunk, for the tips of the stiff ventral bristles, when set against the rough surface of the bark, aid the porcupine in clinging tightly to the tree, thus preventing it from slipping backwards. The tail is so strong that the animal can very easily support its whole weight by clinging with its hind feet and the terminal three or four inches of its tail, while it uses its fore feet to reach for and hold small limbs and twigs from which it feeds.

Porcupine quills are greatly modified hairs which through evolution have become heavy-walled, stiff, strong, minutely-scaled, sharp-pointed spines, each of which, like a hair, grows from a small pit or follicle in the skin. When they are lost by molting, by combat or in some other way, they are replaced by the growth of new ones from the same pits or follicles from which the former ones were lost. Hairs are replaced in the same manner.

The length of the quills ranges from less than one-half inch to more than four and one-half inches. The longer ones usually have weaker and more slender shafts and therefore are less efficient as weapons and also less effective as penetrating structures because they bend and break more readily than the shorter sturdier ones. The sturdiest and most effectual ones are those which range in length between an inch and two and one-half inches. The walls of these quills are more or less cylindrical, relatively heavy, stiff, strong, and the tips are very sharp, so that when pushed or driven straight forward by the tail they have considerable ability to penetrate flesh and even to pierce a piece of wood. The great numbers of minute scales on the surface of the quill greatly enhance its power to continue its penetration of the tissues and also to maintain its hold in the victim, the result of which is the withdrawal of the quill from the skin of the porcupine. These spiral rows of very numerous, minute, sharp-pointed, surface scales are arranged like shingles with the pointed ends of the scales directed towards the base of the quill. The spiral rows run from the tip of the shaft of

the quill towards the base. When dry, the scale points lie rather closely against the shaft, but when moist the points tend to rise slightly above the surface of the shaft.

Particularly well-developed muscles are attached to the skin of the porcupine and these muscles give the animal excellent control of the movements of its skin. When the animal is resting or when it is undisturbed, its hair and quills lie flat and close to the body, but when it is disturbed by a sharp noise, by an unfamiliar sound, by the approach of another animal, or by something touching its tactile hairs, the porcupine either bolts and runs away or stands and assumes a defensive attitude. When this attitude is assumed, the contraction of the skin muscles erects the whole hair and quill covering of the head, body and tail, so that the thousands of quills standing on end stick out in every direction. When they are thus erected, it is impossible for another animal to come in contact with the porcupine without having a few or many of the quills implanted in some part of its body.

The tail of the porcupine is another excellent defensive structure. It is a moderately long, heavily built, club-like appendage, composed of strong tail vertebrae and many stout and well-controlled muscles. The tail is powerful, rapid in action and bears on its sides and upon its upper surface large numbers of quills of various sizes and lengths which extend in all directions. The quill-studded club also bears numerous, medium long, very sensitive fine coat hairs which enable the porcupine to know when the tail area is touched. These fine hairs are such efficient tactile structures that when a person simply blows his breath against them, the porcupine responds by erecting its quills and by striking with its tail. When another animal touches these hairs, the porcupine immediately begins to strike so forcibly upwards and outwards with its tail that the tail quills may be driven deeply into the other animal. When a cow encounters a porcupine on the ground, her curiosity frequently leads her to walk up closely to nose and sniff at it. In such a case her nose is almost sure to be struck one or more times by the tail, which drives twenty-five to fifty or more quills deeply into it. These make her nose so sore and painful that she is unable to feed normally until they are removed. The

longer they remain, the deeper they penetrate.

During such an encounter the porcupine habitually keeps its head turned away from the enemy and its tail turned towards him, always holding it low where it is ready to strike. Whenever possible, the porcupine pushes its head into a hollow space or under a projecting object, thereby protecting its head and shoulders while its "rosette" of quills shields the remainder of its body and its flailing tail delivers its blows.

The winter foods of the porcupines in north-eastern United States consist of the bark, buds and leaves of evergreens, such as hemlocks, pines and spruces, also the buds, twigs and bark of various deciduous trees, such as poplars, birches, maples, willows, elms, etc. As spring approaches, leaves of deciduous trees are added to the diet; still later, the herbaceous plants in the woods are used. Along streams, aquatic plants may be eaten and near farm areas the porcupine may turn to crops like clover, alfalfa, beans and orchard fruits, especially apples.

The porcupine has a great liking for salt and will make considerable effort to obtain it, even when the salt is present in minute quantities. Old logs and stumps that have been well salted will attract these animals and often they will continue to gnaw away the wood until it is almost completely eaten up. Boards, timbers, floors, tables, etc., which contain the residues from soapy water or salty grease, and axe handles, canoe paddles or other wooden tool-handles which have been well impregnated with sweat from human hands, are readily gnawed and ruined by porcupines seeking the salt. Urine- and sweat-impregnated boards in camp toilets are also of prime interest to these animals and in certain camps much damage is annually done to some of the buildings. Damage of this kind can often be reduced by putting out salt blocks.

When porcupines are too numerous in a region, or when they attack trees in a very limited area, or attack especially desirable ones which are few in number, they sometimes do some harm by removing patches of bark, causing "spot damage" or "blazing" which leaves ugly permanent scars on the trees. They may also completely girdle certain limbs or the trunk, which will eventually kill the damaged portion. In the case of various evergreens, after being girdled

they continue to grow for some years but they remain weak in that they do not increase in diameter at this area so that in time the wind snaps off the tops at the point of injury, completely spoiling the growth for timber.

Recent studies of the eastern porcupines in the Vivarium at the Biology Department of the University of Buffalo have brought out certain points about breeding habits. The males initiate a very interesting pattern of courtship which extends over several weeks prior to the real breeding period. In the laboratory, breeding has occurred in each month from September to January, although most of it has occurred in October and November. There may be some variation in the length of the breeding season in the wild and in the laboratory. The gestation period, i.e., the time between the breeding and birth of the young, has been determined to range between 205 and 217 days, an average of 210 days, or seven months. Multiple births in the northeastern United States appear to be rare.

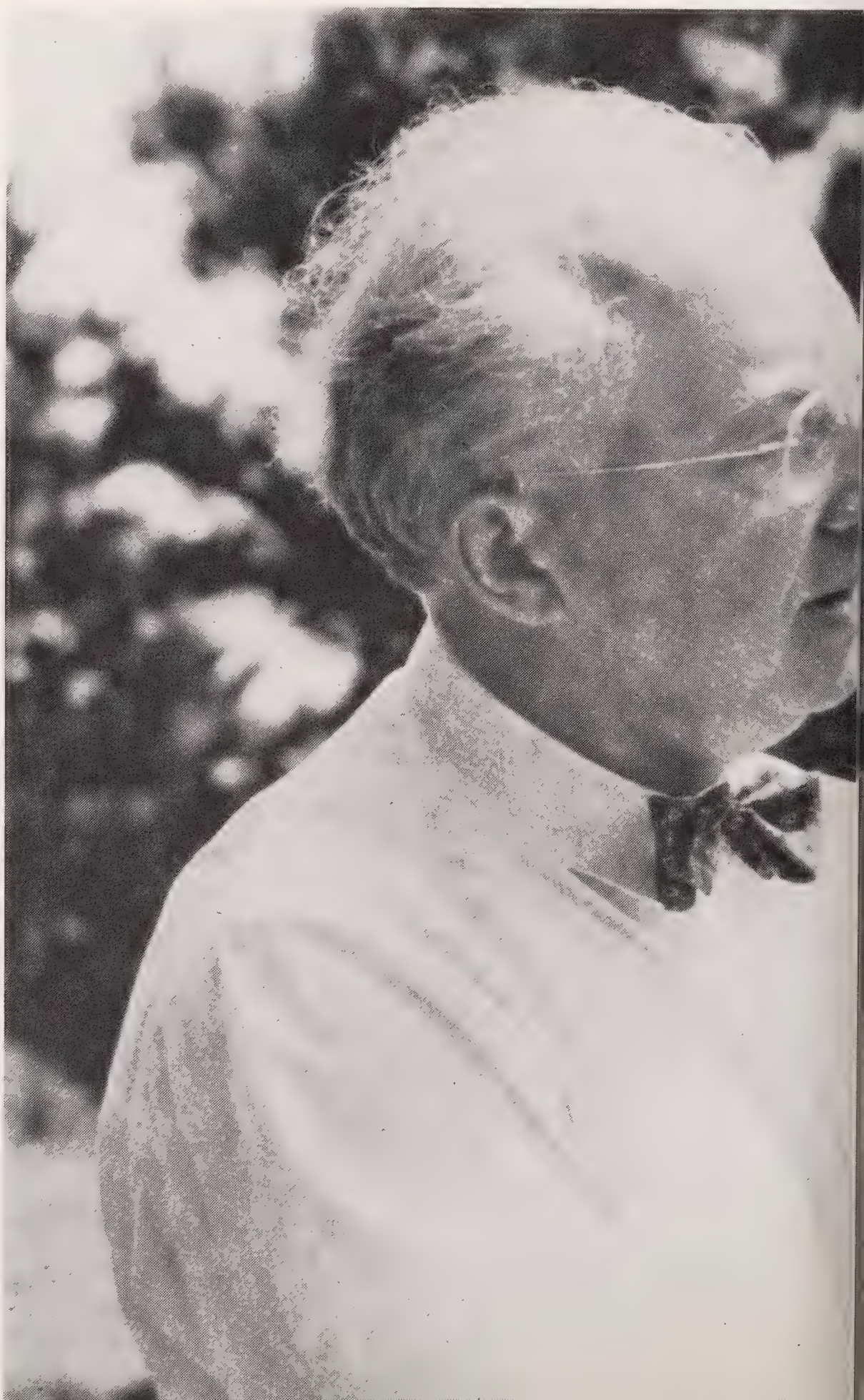
No nest is prepared by the mother for the young, but at birth the little porcupette (the nursing young) is very well developed; the body is covered with heavy, long, black hair which is well interspersed with numerous quills measuring up to one-half inch or more in length. The eyes are open, the first eight teeth are in functional position and the porcupette uses both its teeth and its quills to protect itself. Within a few minutes after birth it is able to walk about and within a day or two it is able to climb. Within the first hour it responds to calls from its mother and to moving objects and executes such defensive reactions as hiding its head, striking with its tail, erecting its quills and doing an "about-face" to protect its head and to use its tail. The coordination of muscle action is remarkably good when it is only a few hours old.

Although the literature usually states that the little porcupine nurses for only ten days to two weeks and that it is able to support itself on solid food after that time, this has not been true in our laboratory. Our studies have demonstrated that the porcupette nurses from three and one-half to four months or longer unless it is forcibly weaned by its mother. Some individuals are very persistent in nursing and sometimes a porcupette

will force its mother to suckle it for some time after she begins her attempts to wean it.

In assuming the nursing position, the female rears up on her hind feet and tail and sits hunched forward in a semi-erect position with her fore limbs hanging limply at her sides. She makes no attempt to clasp or to draw the porcupette to her but permits it to nuzzle about the hair of her breast and belly to locate the nipples. The new-born porcupette nurses several times during the day and night, taking small amounts each time. When the mother has walked away at night to feed while the porcupette is asleep, upon waking the little one will search and if it does not find her it will begin a series of high-pitched, complaining, baby-voiced whines, repeating them every few minutes until the mother responds to its calls by returning to nurse it.

At birth the porcupette weighs from ten to twenty ounces and it grows rapidly during the nursing period. When only a few days old it begins to nibble bits of fresh green leaves of various kinds and a little later it takes some green



bark and tougher materials. By fall it may weigh as much as four or more pounds and should be feeding entirely on solid foods.

Although the mother is rather solicitous about her new-born and follows it closely, she makes no attempt to fight for it. Because the mother depends upon the little porcupette to protect itself, it is relatively easy to pick up and handle the young if proper technique is used. If it is handled very kindly and gently, it quite readily becomes accustomed to human beings. A motherless porcupette that must be bottle-fed will respond still more easily.

After feeding, particularly after the evening meal, porcupettes are often quite playful; they will climb, run about, jump, buck, erect their

Porcupines are occasionally found in which there is complete lack of pigment in pelage, claws and eyes.

Photo by Robert D. Weigel

Porcupette-supporting technique is demonstrated by the author, using a baby three months old.

Photo by David Nichols



quills and strike with their tails. Two or three playing together become quite vociferous in their cries of protest during rough romping and wrestling. A bottle-fed porcupette will follow its foster parent about like a kitten.

Laboratory-raised porcupines at all ages are easily handled. They respond to conversation and commands and become so accustomed to gentle treatment that they can be picked up by the feet or by the tail without offering any objections. They are not the stupid animals that they are usually said to be but learn rather quickly when treated with patience, kindness and gentleness. They have lived as long as ten years in our laboratory and in the wild they may reach ages of ten to twelve years or more.

In the wild, porcupines sometimes become too destructive or too numerous and must be controlled. However, when control measures are necessary, control does not mean extermination in the area but simply reduction in numbers, for they should be allowed to maintain their place in our woodland fauna. Being older inhabitants of this continent than man himself, let us then concede to the porcupines the right to continue among us here in North America.

A FLOCK OF TAME BUTTERFLIES has a ridiculous lot in common with a holiday inn full of human beings. Both groups like meals and sociability, sunbaths and siestas; there is usually a middle-aged female busybody, and the arrival of young guests often throws the whole community into a dither. The keeper of either butterfly house or inn must, as a matter of course, provide food which is unexotically superb and surroundings which are plausibly rustic; heaven help the host who asks his guests to accept pecu-

and even breed, but their activities are distorted, and though you may raise a fine healthy brood of caterpillars, you will have no reliable data on the normal habits of their parents.

At the Department of Tropical Research laboratory at Simla, in Trinidad, we needed a place where we could keep butterflies under observation day and night, bring together those whose social activities were of special interest, and perform experiments on color vision and the uses of color, under conditions of ease both to the butter-



HOUSEKEEPING FOR BUTTERFLIES

By JOCELYN CRANE

Photographs by Department of Tropical Research

liar meals or really to rough it. Above all he must cultivate unshakable cheer in the face of unforeseen foibles, whether lepidopteran or human.

Ever since his years in British Guiana, Dr. Beebe had wanted to build a large butterfly cage out-of-doors in the tropics. Satisfying as it is to watch the flash of wings—blue and scarlet, orange and gold—in a jungle glade, it is downright frustrating to try to study butterflies under these conditions alone. We see only scraps of behavior patterns, hints of adaptations to living, or mere suggestions of the capabilities of their sense organs. Similar troubles occur when you keep butterflies in restricted cages. Some *may* live

flies and to ourselves. A successful butterfly house would be the answer, and this past season we had at last exactly the right place to try one out.

The idea had already proved practical across the Atlantic. In Germany during the nineteen-twenties and 'thirties Dr. Dora Ilse performed notable experiments on butterfly vision, using in turn a greenhouse and a large cage. A bit later, in the Netherlands, Dr. N. Tinbergen and his associates set a flat-topped, cloth netting cage, fifteen feet square, on the lawn for some fine work on the behavior of the Grayling Butterfly, which supplemented their observations on the free-flying specimens in the field. Over the years in both England and America many species have been

bred by scientists, amateurs and commercial breeders in cages of various sizes and kinds, including all sorts of successful makeshifts from shoeboxes to English butter tubs. According to the published reports, about all that was needed to insure breeding was a very modest amount of space, fresh air, plenty of light, ample nectar from fresh or artificial flowers and proper food plants on which incipient mothers could lay their eggs.

Despite these helpful precedents, we had al-

wooden stool in the middle, and hopefully introduced our first inhabitants — two red and black helicones and, our pride and joy, a great blue morpho. All three flapped dizzily about, batted wildly against the roof, were blown flat against the west end by the afternoon tradewind, ignored the flowers — and vanished by morning. All, that is, except a few scattered scraps of blue and scarlet wings.

It took just about three months to eliminate, one by one, our troubles. First of all, the ma-



most as much trouble with our pioneer tropical house as an Esquimo trying to build an equatorial igloo. We started off sagely enough with a modest cottage 18 feet long, 12 feet wide and 9 feet up at the ridgepole. We congratulated Henry Fleming in planning the roof with a specially steep slope against the tropical downpours. Including the roof, it was entirely fashioned of antiqued bronze netting, of the kind used for house screens. All this was fastened on a stout wooden frame, a neat spring-shutting door attached in one corner and the whole set in the laboratory compound, half in the shade of the nearest mahogany tree. We stamped the earth down neatly inside, placed a bunch of fresh scarlet jungle blossoms on a small

This is the second insectary built at Simla—a structure 24 by 33 feet, incorporating many lessons learned in the smaller first building.

hogany tree was useless as shade on a blazing afternoon when the sun slanted under its canopy. Simultaneously, the tradewind, flattening the helpless butterflies against the netting, exhausted them completely. A matting of wild banana leaves, tacked against one end and over part of the roof, acted as both sun- and windbreak, a feature apparently little needed in the soft European summers. By the next year the dried leaves were replaced with a riot of green and flowering vines — passion flower, blue Thunbergia, Beau-

montia lily and star jasmine. On hot afternoons, too, we found it essential to sprinkle the premises with the garden hose, since hot and dry butterflies soar high and wildly, batting themselves against the roof and not feeding.

A mysterious trouble — the death of butterflies which spent much time on the netting — was apparently traceable to an effect of the metal itself. Perhaps in sucking water on the screen through their probosces, some dissolved poison from the wire was absorbed.

One of the most surprising needs of our butterfly guests still appears, in our ignorance, to be a purely aesthetic requirement. This is for green growing things about them. There is no doubt a completely scientific explanation, probably involving the adverse effects of infrared radiation



from the bare earth, but we do not yet understand it. After all, green foliage also reflects infrared. Butterflies that were well fed, watered, sunned and sheltered still dropped and died, until green grass and plants covered the ground and climbed lushly up the sides. In the first stages of this interior decoration, epiphytic bromeliads served admirably; they were tied on the branches of cut saplings which were leaned against the inside walls of the cage. They furnished both green and perches. Later we added grass and many sorts of growing flowers and shrubs, from ordinary Spanish needles and lantana, both be-

loved of many butterflies, to our very best Simla orchids. In addition there were always fresh cut flowers and pots of food plants for the next generation — passion flower for *Heliconius* eggs, citrus and *Aristolochia* for the swallowtails. Little by little we found the favorite foods of the more finicky species. Swallowtails like *Ixora*, while no butterfly will touch the equally red *Pachystachys*, although neither one has more than the most delicate of odors to our noses. Some, especially morphos, caligos, preponas and satyrids, scorned all flowers, but were greedy over fruit — bananas, papaw, mango and cashew — all, generally, much too ripe for our own luncheon table. Nevertheless we once scandalized some mango-loving guests by presenting the very first mango of the season to the appreciative butterflies.

Our final hurdles involved our ceaseless fights against the marauders of the house — ants and spiders, mantids and lizards. The ants were ubiquitous; some voracious primitive kinds will seize a slightly weak butterfly and literally de-

The first insectary, 12 by 18 feet, was greatly improved by a sunshade of *Thunbergia* growing over one end.

Dr. Beebe at work in the insectary which gave a perfect opportunity to examine butterflies at close range.

vor it alive; others are scavengers, promptly eating all but the wings even before the casualties can be salvaged for our collections. The only safe procedure is promptly to remove all inhabitants which are not in the best of health. Orb-weaving spiders are another hazard; each morning the butterfly house must be cleared with a broom poked in all the corners, high and low; never was good housewifery more important. Large praying mantids have found their way in once or twice and waxed fat on precious specimens before they were caught in the act. And finally, big *Ameiva* lizards sometimes burrow under the frame and bide their time to catch an inmate, as it sunbathes carelessly near the ground.

One of the biggest surprises about some butterflies is their amazing tameness in captivity. Dr. T. C. Schneirla has a word for this acceptance

of strange conditions by other animals: "habituation learning." It works mysteriously in our butterflies. Just as some wild ducks become easily tamed while others won't, so some butterflies, such as our red and black *Heliconius*, make themselves promptly at home while others bat wildly against the wire, or hang inactive all day long. What makes the difference we have not the least idea.

There is a difference in behavior even of the naturally tameable, however. That depends on whether the cage is "seasoned" with butterflies of their own or related kinds. New inhabitants settle in with astonishing swiftness, sometimes feeding within a few minutes if others are already there, like wild ducks landing cozily among decoys. Also, even though the butterfly house has been empty for days, readily tameable guests settle in more quickly than into a house which is new, or has been tenantless for months. Without doubt the difference is caused by the permeation

of the cage by butterfly odors. It seems there is nothing like a whiff of its own species to make a butterfly feel at home.

Once a butterfly has settled in, his tameness is a pleasure. He will fly to you as you enter the door, to alight and feed on the flowers you bring. You can lift him, still on his chosen blossom, without disturbing him. You can even carry him gently by the wings and place him on another flower. He probably will not stay just there, but he will show no signs of panic when he flutters off. Imagine, in contrast, taking such liberties with a butterfly at large in the garden! One of the most delightful experiences is to present a great blue morpho in the butterfly house with a bit of banana. As you hold the fruit he walks toward you until his speckled hazel eyes are scarcely an inch from your finger. Then out comes his proboscis, the delicate curling tip probing here and there in the delectable mushiness. In a moment he climbs altogether on the fruit and you





Incidentally, you cannot shoo a butterfly into the way you think he ought to go — whether to breakfast or bed, toward an experimental tray of paper flowers or in the direction of another butterfly. Any butterfly can seem as stubborn as a mountain donkey. The most you can do is gently to stir up a somnolent individual and hope that in the resultant flight he will deign to flutter in the direction you wish. Sometimes a reluctant suitor may be led by means of a nosegay held carrot-in-front-of-nose-fashion clear across the cage to the side of his potential mate. But after that the proceedings are strictly up to the butterflies.

Broken wings may be mended with Scotch tape; the strips, however, must be as short and narrow as possible, since a butterfly is not designed to carry a pay load. Even a heavy coat of

A Great Blue Morpho could be tempted to feed from banana in the hand.

Such heavy planting as this was important to survival of butterflies.

may carry him where you will. Yet only days before he was merely a dazzling flash above a jungle stream.

Butterflies are like puppies, canaries, monkeys and human small fry: you can always tell right away when they aren't feeling up to par. A sick beetle or boa constrictor may seem very much as usual to a casual eye, but an ailing butterfly is unmistakable; he hangs for hours inactive against the screen in the best of weather, or bats about abnormally high near the ridgepole. He has no appetite, he doesn't chase his fellows, and he is very likely to sleep alone against the wire instead of joining the gang on the twigs of the roost. If his ailments are merely due to a kind of shock following capture, to anaesthetization with carbon dioxide or to handling during painting for color experiments, a good night's rest will usually fix him up. A flower moved slowly and gently under his proboscis will often induce a peckish butterfly to feed. Usually he will then climb on the blossom and allow himself to be carried, still sucking, over to the food bouquets, where he will continue his meal more conventionally and be thereby swiftly restored to his energetic self.

paint on a small portion of a wing, such as is applied in changing the color experimentally, may keep an egg-laden female as firmly earth-bound as a caterpillar. In spite of this sensitivity to extra weight, however, butterflies often fly for days with badly tattered wings, as anyone knows who has watched our northern gardens as the summer wears on.

Usually large, strong, high-flying butterflies such as morphos, preponas, caligos and swallow-tails, need much more space and height than less active species. For these we built a big cage, a Grand Central Station affair measuring 24 x 33 feet in area and a lofty ten feet plus at the ridgepole. It has proved a great success and does double duty as a stock house where all the species we are studying can get along well without crowding.

"Flutter Inn," our smaller original house, we keep for special observations, experiments and much of the photography. It is a good place, for instance, to study courtships, as it is easier to keep the wild chases of the protagonists in sight.

Butterfly courtships are almost always strenuous affairs, preceded by the colorful swoops and



dashes and dodges of pursuits all over the house. Usually the courting pair eventually settles down with the female resting more or less quietly while the male hovers above her, spraying her energetically with perfume from his special scent scales. She meanwhile is wafting perfume of her own about, sometimes with a lively kind of static flutter all her own. In Trinidad we are still working out the details of these courtships and of the respective parts played by motion, color, odor and even sound. It is a fascinating subject, and most of our fast-accumulating results would be nonexistent without our butterfly houses.

Our hope is that somewhere here in the north people may come to build similar roomy butterfly inns, and so open the way for equivalent studies of butterfly behavior patterns. Far too little is known in any animal group of the differences of behavior in tropical and northern cousins. True, houses up here could be used only in the summer, but what a wealth of butterfly lore could be learned during a single Westchester June!

It does not take a fullfledged scientist to make a real contribution to knowledge in this field; a devoted amateur would be fine. He could do a

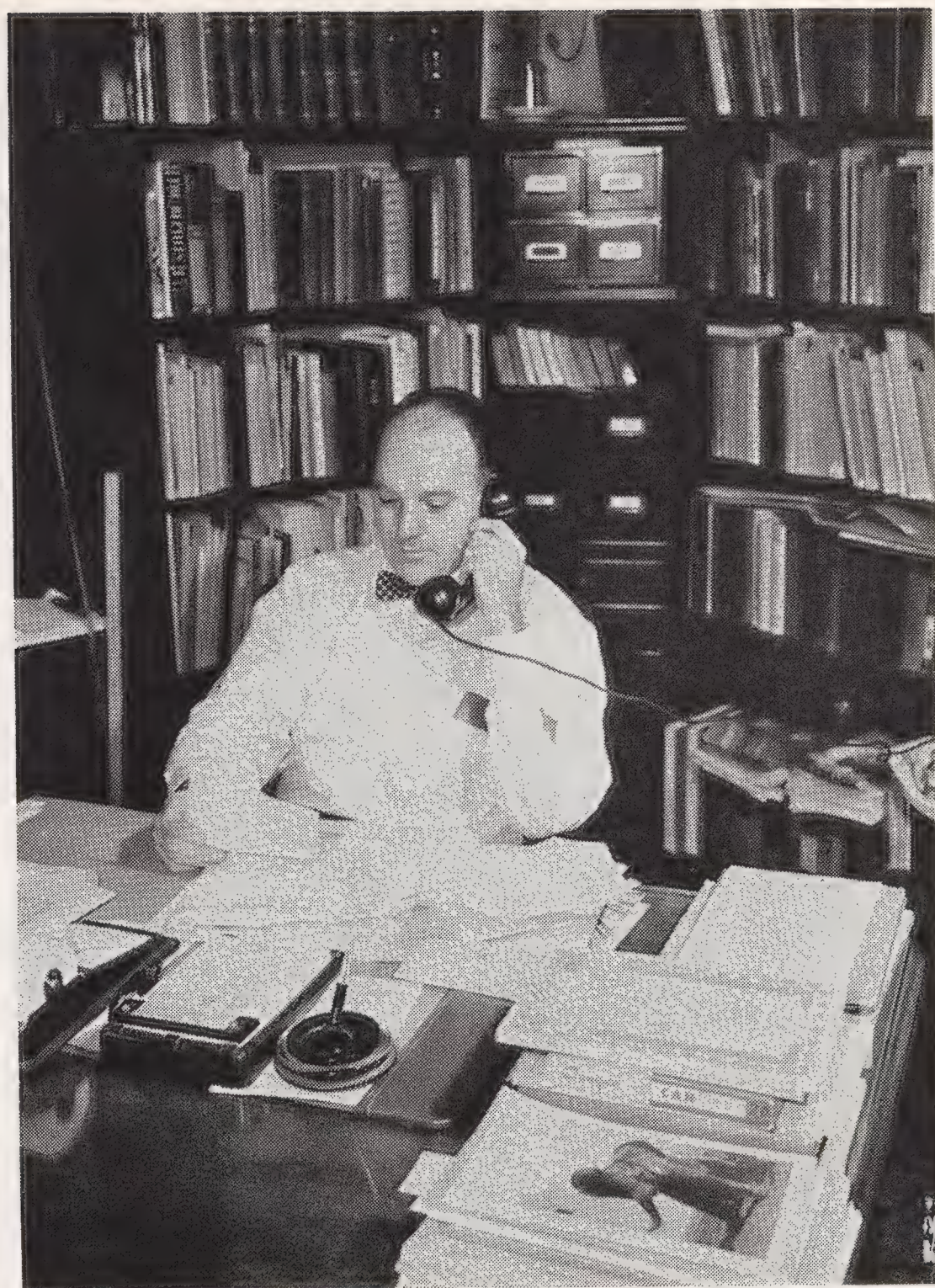
lot of the scientist's preliminary work — in some ways it is the most challenging and entertaining part — with great success, and any zoologist following in his footsteps would bless him for his breaking of the sod. For example, he could determine which of our local butterflies settle in best to a life of captivity. How long will they live, with plenty of food, space and care? (Some of ours in Trinidad live less than a week; our record was a grandmother who finally escaped spryly into the garden at the advanced age of 93 days). How many kinds and individuals can be kept healthy at once in a cage of a given size? How long after they come out of the chrysalid do the females lay eggs? Which of their favorite flowers last best in water? How much sun, shade and moisture do the various kinds need? Can they be induced easily to feed? Where do they sleep? In groups or alone? Which species go latest to roost? Which stir earliest in the morning? Do they behave oddly before thunderstorms? Do the males chase each other? What is their courtship like? And so on and on and on. Please start a butterfly house, somebody, and have as many headaches as we do . . . *and* as much fun.

Save Our Snake!

By JAMES A. OLIVER

THE INTERNATIONALLY RECOGNIZED call for help is S.O.S., easily remembered as "Save Our Ship." In the Reptile Department at the Zoological Park it is a distress signal often received but more likely to mean "Save Our Snake." By mail, by phone and by personal visit the calls come in from everywhere. Not long ago a letter started off, "Here's an urgent S.O.S. My pet is in trouble." All of the animal departments at the Zoological Park respond to similar emergencies. To indicate the varied nature and sources of these pleas, here are a few that have come to the Reptile Department.

A reptile exhibitor in Canada wrote to ask for prompt advice on how and what to feed two large Anacondas that refused to eat. The superintendent of a large zoo in Asia wrote for information on the treatment of his 24-foot python that was suffering from a swollen lower jaw. An amateur herpetologist in El Salvador was concerned about what to feed his Emerald Tree Boa. A student from New Mexico who is attending an eastern college accompanied by his two pet Prairie Rattlesnakes, found himself in trouble with the unsympathetic authorities of the college. It seemed that the Dean of Discipline took a dim view of students who brought rattlesnakes to school and had ordered the reptiles banished from the halls of higher education. The distraught student asked us if we would give his



pets a good home to save them from being destroyed. We could, and did.

With tact, sympathy and understanding, a mother wrote last fall that her son's heart was set on getting a live snake for Christmas. She said that this present was desired above all else and that while she was personally unenthusiastic about the project, she did not want her boy to suffer frustration. Where could she get a nice harmless snake and how should she take care of it? Another understanding woman phoned from a suburb of New York City to ask how she could make a pet of a snake that she had seen beside her duck pond. She had always been afraid of snakes, but now she wanted to overcome her fears by making friends with this snake. It lived in a rotten stump beside the pond and was apparently a Common Water Snake. Several months after her first call, she kindly reported that she was making good progress. The snake was feeding on the pieces of raw fish that she placed on a board beside the stump. This is undoubtedly one of the few snake-feeding stations in the world!

By telephone we received a call from an excited woman in Brooklyn who had a large South

American *Boa constrictor* loose in her store. Some misguided humorist had sent it to her as a present and it had escaped from its container. It was causing a considerable stir among the usually blasé Brooklynites entering the store. Would we please come and get it immediately? The woman was understandably eager to donate it to the Zoo. Similar but usually less excited calls are regularly received from several of the banana importers in this area.

Our most frequent calls for help are from the owners of pet turtles. These individuals comprise a large and often fervently devoted group. Many show a commendable intelligence and interest, but a small minority operate with an appalling ignorance of the biology of their pets. One tearful woman called to say that her turtle had accidentally fallen out of a window and landed ten floors below on a concrete sidewalk. What should she do for it? We still wonder at the mental equipment of another woman who put her pet in boiling water "to cure its cold." The animal had not moved for three days since that time. What would we advise her to do?

Most of the calls or letters on turtles are far less gruesome than these, but many indicate a woeful lack of information on the proper care of pets. Many ask what they should do with turtles that have outgrown their accommodations or are no longer wanted. We accept such animals as donations to the Zoo to insure that they are taken care of properly. We receive such great numbers of these animals that from time to time we must send the excess to other zoological parks, particularly in Europe. As an indication of the number of such donations, we received 550 young alligators during the past ten years — an average of 55 a year! I do not have the figure for the number of turtles brought in, but it would be much higher.

A boy wrote a few summers ago and eagerly asked how he could fertilize his turtle eggs. His pet Painted Turtle had laid some eggs, but he was not sure they were fertile and he badly wanted to have some baby turtles. One woman apparently wanted her pet turtle psychoanalyzed. She brought it to the Park in its bowl and sadly reported that the turtle no longer recognized her. Formerly when hungry it would swim over to the side of the bowl and extend its right foreleg,

putting it on the index finger of its owner. For a week now it had refused to do this. What was the matter? Was it sulking, unhappy, sick? "Please help me. I'm so fond of it that I couldn't bear to have anything happen to it." A similarly enthusiastic owner of a pet alligator wrote us several times and called us long distance from Phoenix, Arizona, to ask for additional information not covered in the letters.

One of the most unsettling phone calls I have received was about a pet turtle that allegedly chattered so loudly at night that it kept its owners awake. How could it be quieted down? Now, turtles are voiceless except for a hissing or wheezing sound when air is forcefully expelled, so I was completely skeptical of the report. However, the caller was insistent that his turtle frequently made a loud noise. In fact, just last night they had to move its tank out of the bedroom and close the door in order to sleep, and most of the morning the turtle had been chatting with his wife while she did the ironing. I muttered incredulously something to the effect that turtles were voiceless and that this was a hoax or else the turtle had a bad respiratory congestion. The indignant owner said that I was a disbelieving scientist and would I like to talk to the turtle? Before I could reply that I was too busy to continue with this preposterous conversation, I heard a soft, "cluck, cluck" on the other end of the line and my reason began to totter. Then the owner said, "Did you hear that?" I replied in the affirmative and he said, "That's not the turtle. That's me trying to get him started!" A brief silence and then a report that the turtle was not in a talkative mood at the moment. I suggested that the next time the turtle was talking they bring it to the Park so that I could make a tape recording of it. I have heard nothing further from the talking turtle — and don't expect to!

From these samples it is readily apparent that the calls for help that come to us are varied and interesting. They come from all over and frequently represent moments of urgency and anxiety for the callers. Whether the requests come as an S.O.S., an urgent call, or a simple plea, all require some acknowledgement or answer. It's all part of our day's work — and *some* days it's really fascinating!

NEWCOMERS IN THE ZOO

Photographs by SAM DUNTON

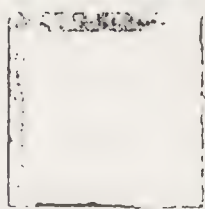


This inquisitive Sapphire Mink allowed itself to be captured in a net when it was found at a fishing camp in Putnam County.





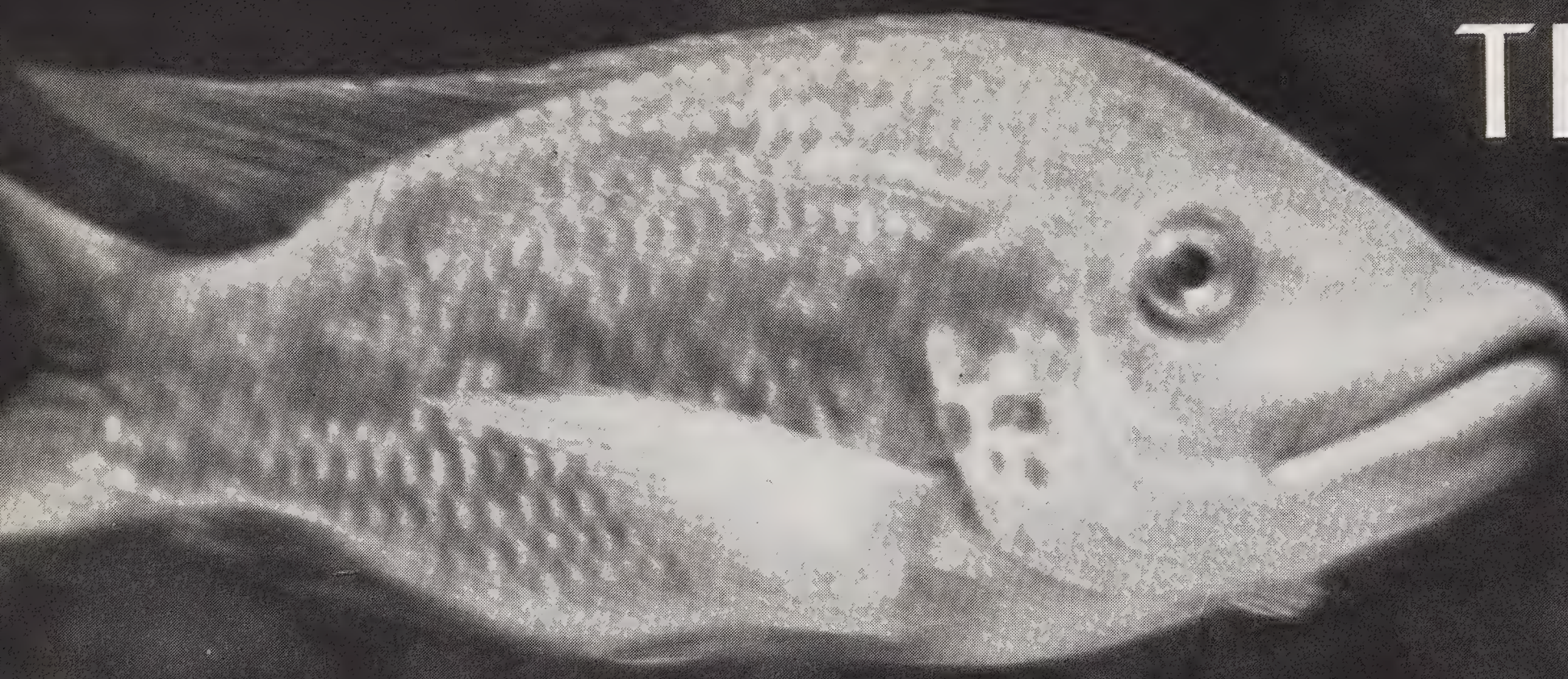
The Sick-winged Guan of Colombia, Ecuador and Peru gets its common name from the strongly-arched outer flight feathers.



Another bird rarity is the Wattled Guan of Colombia, Ecuador and the Andes of Venezuela. It is named for its neck appendage.



A Northern Hooded Skunk, one of the showier forms of this interesting animal, had been a family pet before it came to us.



THE PEREGR

IN HIS LONG, HARD FIGHT for a place in the sun, man has had the help of other animals almost from the beginning. Long before he learned to write, to make things out of metal or even to plant and harvest crops, ancient man had discovered ways of keeping dogs and hoofed stock to make life easier for him. The domestication of animals, like the use of fire and the cultivation of plants, is one of the really basic human discoveries upon which all subsequent civilization has depended.

But the incalculable benefits derived from domestic animals were not obtained without effort. The creatures had to be fed, watered and protected from both their enemies and the elements; in fact, the more productive and useful they became, the greater became their dependence on man for food and shelter. No one can say just when man first started to dream about an ideal domestic animal — one that would be marvelously helpful without requiring any care on his part — but it was surely long ago because the idea of getting something for nothing seems to be a fallacy that has plagued men from the earliest times. Moreover, the fact that animals multiply lends credence to the belief that here, indeed, is the miraculous creation of wealth out of nothingness. Such ideas are embodied in old fables like *The Goose that Laid the Golden Egg* and in a fanciful creation as recent as Al Capp's *Shmoo*. They are also behind the get-rich-quick schemes, involving the raising of everything from earthworms and bullfrogs to chinchillas and skunks, that at one time or another have been passed off on an all too willing public — not that

many of these enterprises cannot be made to yield legitimate profits, but that they require time, energy and know-how. Such misplaced faith in the powers of nature has made well-meaning but overly optimistic people proclaim that the economic salvation of whole regions could be accomplished merely by introducing the right species of animal into them; an example is the proposal made a couple of years ago to bring Musk Oxen into rural New England.

The latest of these “miracle animals” is a fish whose prolificness and adaptability have given it the reputation of economic rehabilitator and social savior of many of the world's underprivileged people. In this exalted role it has been transplanted into waters two-thirds of the distance around the earth.

This fish has no generally recognized popular name. In parts of its native Africa it is called the Largemouth Kurper, Bream and Mudfish, but none of these has been applied to it anywhere else. The fish has become widely known by its generic scientific name, *Tilapia*. This appellation is not entirely satisfactory, however, since there are several score of fishes belonging to that genus. Although it would be more exact to use the full scientific name, which is *Tilapia mossambica*, nevertheless, when anyone mentions *Tilapia* today, it is pretty safe to assume that *Tilapia mossambica* is the species in question.

The Largemouth Kurper, or *Tilapia*, was originally confined to eastern Africa where it inhabits both fresh and brackish waters. It is regularly found in estuaries as well as rivers entering the Indian Ocean, from Ethiopia south

NATING TILAPIA



By
JAMES
W.
ATZ

to Algoa Bay, which is near the southernmost tip of the continent. It also occurs in landlocked waters. Because it is a desirable food and game fish, South Africans have planted the fish in numerous natural and artificial bodies of water within their Union. For example, the species has now become established in at least one river near Cape Town, several hundred miles from its nearest natural habitat.¹ Although they recognized the Largemouth Kurper as a good angler's fish with high table quality, Africans did little or nothing about culturing it intensively — undoubtedly for the simple reason that the fish reproduced itself in nature sufficiently to meet their need of it.

How and when Tilapia left Africa and came to the East Indies is a mystery. Its presence in East Java was discovered in 1939 by an overseer of fisheries. Mr. W. H. Schuster, in charge of the Fisheries Service, investigated the matter and found five specimens of a fish entirely new to that part of the world, two of them bearing eggs and fry in their mouths. "The overseer, Pak Mudjair by name, explained that the new fish was collected by him in the small lagoon of the Serang River on the south coast of Java, but an investigation there yielded no further material or information."² Well aware of the dangers of introducing new species of wild life helter-skelter into a country, Mr. Schuster tried to control the propagation and spread of the strange fish, but the ease with which it could be bred and the rapidity with which it grew made it so popular with Javanese fish culturists that Tilapia were quickly carried to various places all over the island. Thousands of

crude ponds amounting to little more than holes deep enough to fill up with ground water, were dug and stocked with Tilapia. All that was necessary was to feed the fish with kitchen or other wastes; sometimes they even grew and multiplied with no care at all.³ In honor of its discoverer the fish was named "Ikan Mudjair," which in Indonesian means Mudjair's Fish. The new immigrant made itself at home in a wide variety of habitats, both natural and artificial; it soon was flourishing in lakes, brooks and swamps as well as fishponds and drainage ditches.

Fish are one of the principal foods of the people of Indonesia. Whereas most Europeans and Americans get their animal protein food by eating meat, dairy and poultry products, Indonesians, like most Asiatics, depend largely upon fish for this vital constituent. Each Javanese consumes approximately 110 pounds of fish *per annum*, and of this, about 17 pounds consists of fish raised in artificial ponds.⁴ The pond culture of fishes is an old and important Indonesian industry going back more than five hundred years. Today the ponds in which fishes are cultivated occupy practically 300,000 acres and produce nearly 36,000 tons of fish each year. In addition to this, more than 150,000 acres of rice paddies are made to yield their share of fish.⁵

With the outbreak of World War II, the Indonesian fish culturing business suffered severely. Many, perhaps the majority, of Indonesian fish growers never spawned their own fish, but purchased fry from dealers, who in turn obtained them from breeders or collectors, sometimes from other countries. The most popular of all pond-

fishes, the Milkfish, never reproduces in captivity, and the collection of tremendous numbers of Milkfish fry in the sea for the stocking of brackish water ponds is a highly specialized occupation that calls for much skill and knowledge. The war greatly curtailed fishing for young Milkfish and almost completely disrupted the coastal shipping by which fry of all kinds were transported. In the ensuing shortage of fish, Tilapia seemed like a godsend. Because the fish bred practically everywhere at all seasons of the year, there was never any shortage of Tilapia fry. Moreover it thrived in brackish as well as fresh water and therefore could be used in the tambaks or brackish ponds formerly filled with Milkfish. The Japanese army of occupation distributed Tilapia widely; in fact, the Japanese called it "Ikan Nippon" and tried to take credit for it as a Japanese fish.⁶ At this time the Japanese also distributed Tilapia in Malaya, and it was probably they who first brought this species to Sumatra and other islands of the East Indies.

The end of the war thus found Tilapia settled throughout Java and also on Sumatra, Bali, Lombok, the Celebes and other East Indian islands and on the mainland of Asia in Malaya. The fish had become established in the wild state in Java and Malaya, having been accidentally or deliberately allowed to escape into streams, lakes or swamps. It is only a matter of time before Tilapia will become part of the native fish-life of all of the islands where it is being kept in captivity. This introduced species bids fair to become a prominent element in the aquatic fauna of much of southeastern Asia.

Tilapia mossambica is not an unusual looking fish. At first glance a North American might take it for one of his beloved Black Basses or Sunfishes. The rough similarity between the two kinds of fishes is deceptive, however, for they are not closely related. Tilapia is a cichlid, that is, a member of the Family Cichlidae. The only cichlid that occurs naturally in the United States is confined to the region of the Rio Grande in Texas, but our tropical fish fanciers know the group well, since it includes such home aquarium favorites as the Scalare or Freshwater Angel Fish. *Tilapia mossambica* itself has occasionally been imported alive into Europe and America as a pet fish, but it grows too large and is not colorful

enough ever to have achieved any degree of popularity.

Much of what we know about the peculiar reproductive behavior of the Tilapia has been learned by observing specimens in glass-sided aquaria.⁷ As the time for spawning approaches, the male Tilapia behaves more and more hostilely toward other fishes, especially members of his own species. Eventually he appropriates a small area on the bottom which he vigorously defends against all comers. Within it he soon digs a shallow, circular pit perhaps a foot or more in diameter. This is done by scooping up the mud or sand in the mouth, carrying it out of the area and then ejecting it. Now the male is ready to attract a mate into his nest. Sooner or later some ripe female follows him there and, after a courtship that may be either stormy or tranquil, the eggs are laid and fertilized.

Tilapia eggs are laid in small batches of a dozen

A female Tilapia taking her brood of quarter-inch babies into her capacious mouth for protection. It is only in the first four or five days after hatching that she does this; later they are on their own.

Photo from F.A.O.

or so, and after depositing each batch, the female turns about almost immediately and takes them up in her mouth. The total number of eggs produced at any one spawning frequently runs into the hundreds, so that the female has quite a mouthful when she finally leaves the nest — more than likely being chased away by the male, since she no longer reacts positively to his efforts to spawn. Carrying her eggs, the female seeks some sheltered spot where she rests quietly. Her principal activity seems to consist of chewing movements with her swollen mouth and throat, by means of which she churns the developing eggs and fry, thereby undoubtedly keeping them well supplied with fresh water. The young hatch within five days, but they do not leave their oral incubator for another few days. Before they are released, the mother fish becomes restive; she acts as if her offspring were irritating her by trying to escape, but even if one or two manage to get out of her mouth, she snaps them up again. Finally, however, the whole brood of youngsters, not quite one-quarter of an inch long, is liberated.

But the close bond between parent and offspring — seemingly so incongruous in a creature



as lowly as a fish — is not yet broken. The baby fish hover in a group not far from their mother, and should a passing shadow or disturbance in the water alarm them, they immediately return to the parental mouth. Both parent and young cooperate to accomplish this remarkable feat; the female “calls” her brood with special movements and they in turn swarm toward her head. Quickly she gathers them in, even swimming about and snapping up any stragglers. If an intruding fish, or human hand for that matter, threatens the family group too suddenly to permit the young to be carried away from danger, the mother fish fearlessly attacks the interloper while the tiny fish scatter near the bottom.

With each passing day, however, parent and offspring become less attached to each other; the female does not catch up her young so readily, and they seem less eager to be taken. They begin to venture further and further away. Four or five days after making their first appearance, the young are no longer taken into their mother’s mouth. Almost fully developed, with all fins formed and with only a remnant of the egg-yolk remaining, they are on their own.

The wonder is that the mother fish, deprived of all food for the ten or more days it takes the young to hatch and develop sufficiently to be allowed out of her mouth, does not eat her brood. Sometimes she does, but usually only when harassed. Male Tilapia are not nearly as ideal parents as their mates. Although they will occasionally take up some eggs, they rarely, if ever, complete the task of incubating them, but swallow the eggs or the young before they are fully developed.

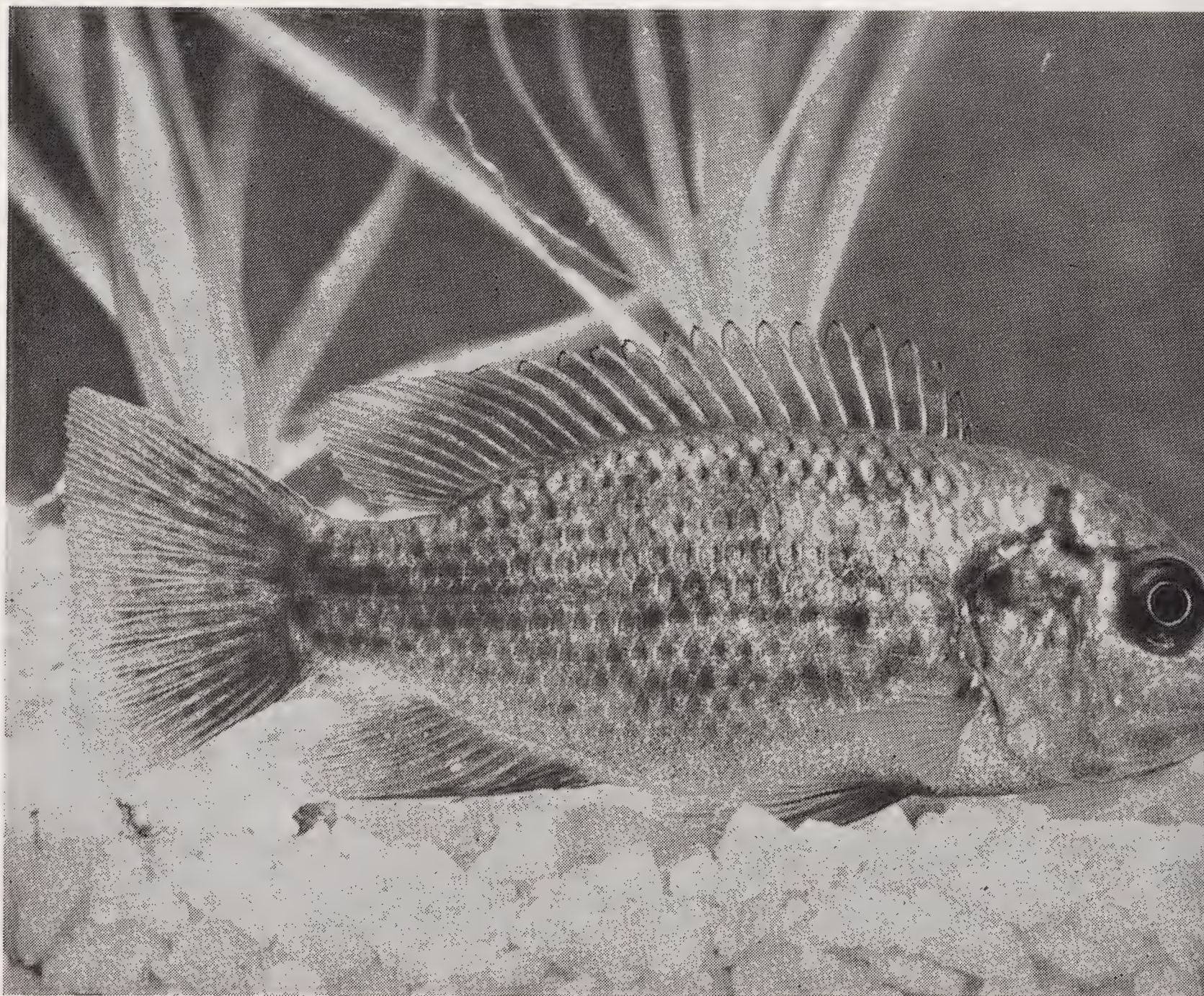
If the way that Tilapia multiplies is any criterion, the protection that it provides its eggs and young is most effective. For instance, a pond which was less than one-fiftieth of an acre in area, yielded 3,500 offspring six months after 50 Tilapia were placed in it.⁸ When put into a half-acre pond 150 young Tilapia produced some 15,000 fish in less than four months.^{9, 10} As many as 14,000 fish have been produced by 14 adults in a period of only two and one-half months.³ Such rates of increase are not large when compared with other fishes that lay, literally, millions of eggs, but these species usually breed only once a year, and their eggs and young, which are at the



**Technicians in Thailand feed-
ing Tilapia in ponds. The Food
and Agriculture Organization
of the United Nations sent an
expert to Thailand to help in
improving and developing
the inland fisheries resources.**

Photo from F.A.O.

**These Tilapia are only four
inches long, but they are old
enough to breed. Before they
reached the Aquarium, they
had 4 broods of 25-50 young.**



mercy of the environment from the very start, must be given special care and feeding by the fish culturist if any reasonable proportion are to survive. Female Tilapia, on the other hand, breed all year round, perhaps as frequently as once a month, and the fry require no special attention at all.

Moreover, the Tilapia is extremely adaptable. It will breed in both fresh water and sea water, and in all brackish admixtures of the two.¹¹ If no mud or sand is present in which to dig a nest, the male will simply clean off a spot on the hard bottom to serve as a place for the eggs.³ The fish spawns readily in dirt ponds or concrete tanks,

in clear or muddy water, in outdoor pools or indoor aquaria. Although primarily a vegetarian, it will eat many different kinds of animal as well as vegetable substances. One of its favorite foods seems to be algae, but other types of aquatic plants are also consumed, including those nearly microscopic, floating ones called plankton.⁹ As a substitute, Tilapia will accept rice bran, the residue from pressed coconut meat and chopped leaves from the tapioca plant.¹² Insects, crustaceans, worms and small fishes are devoured with apparent relish.¹³ Specimens at the New York Aquarium feed willingly on raw chopped meat,

fish and clam and on oatmeal boiled into a stiff paste. Where there is ample food, Tilapia grows rapidly and will attain a weight of one pound or more in eight months or, under very favorable conditions, nearly two pounds in one year.^{2, 12} Yields of as much as 1,000 pounds of Tilapia per acre of pond each year have been obtained, but this is unusually high; half that much would seem a more likely maximum.^{2, 9}

Tilapia's proclivity for eating algae of the long-thread kind, which often grows so luxuriantly that it becomes a nuisance, has made the fish doubly useful in some regions. In South Africa Tilapia have been used to control excessive algal

growths, and in Indonesia and Malaya to combat the malarial mosquito.¹⁴ The *Anopheles* that is principally responsible for the spread of malaria in brackish water areas thrives only in water covered with thread algae. Water with a clear surface contains very few or no larvae of this pest. All that is needed to assure such a state of affairs is to place some Tilapia in the water; in a few weeks the algae, and the mosquitos, disappear.⁶

The fame of this hardy, fast-growing, easy-to-breed and good-to-eat fish spread far and wide. In a world where each year there are twenty-five



million more human beings to feed and where even at present more than half the people are undernourished, no source of food can be neglected. Pond fish furnish one of the cheapest sources of animal protein, which is the component of man's diet most critically in demand. Furthermore, many tropical and subtropical regions, where human dietary and population problems are especially acute, provide conditions suitable for extensive pond fish culture. It is not surprising that the appearance of a new kind of pond fish, which was superior in some respects to the old ones, should excite keen interest among fishery experts. The introduction of Tilapia into

Indonesia and Malaya had been somewhat haphazard, but since the war systematic, planned attempts have been made by the officials of several different countries.

Not all transplantations of Tilapia were made with official sanction, however. In 1946 a Taiwanese (Formosan) soldier, returning from service with the Japanese army in Java, brought thirteen Tilapia back home. These multiplied so extensively, both in natural and artificial waters, that they have become one of the dominant fish of Taiwan.¹⁵

One of Tilapia's most spectacular successes has been won in Thailand. In that country fish culture is not at all as well developed as in Java. After two and one-half years of testing at one of the governmental Fisheries Stations, the transplantation of Tilapia into thousands of widely distributed ponds, ditches, canals, swamps and rice fields was commenced.¹⁶ The Food and Agriculture Organization of the United Nations made the fish a vital part of its program to expand Thailand's inland fisheries. More than 150,000 copies of a pamphlet on "How to Culture Tilapia" have been distributed. Because the raising of this species does not require the skilled techniques needed for Carp and other pond fishes, it has proved an ideal beginner's fish. For this reason and because they like to eat it, the Thai have enthusiastically taken up Tilapia culture.¹⁷ Unlike the situation in Java, the new fish has not yet become established in any sizeable natural bodies of water, apparently because it is unable to cope with the Thai predatory fishes.

From Thailand, the Tilapia was brought to the Philippines. Here it has been introduced successfully into ponds, reservoirs, canals and rice paddies and into certain lakes and other natural waters. The fish gives promise of providing the Philippine people with an excellent source of cheap but tasty animal protein food.¹⁸

Nature was bountiful with the islands of the West Indies, but she failed to provide any of them with suitable freshwater food fishes. In order to make up for this deficiency, Dr. C. F. Hickling, Fisheries Adviser in Her Majesty's Colonial Office, suggested that Tilapia be introduced. This suggestion was promptly followed by Mr. Swithin Schouten, Agricultural Superintendent of St. Lucia, and Mr. Derek W. le Mare

of the Fisheries Department of Malaya. Through the good offices of Paramount Aquarium, Inc., the largest fish importing concern in the United States, 450 young *Tilapia* were transported by boat from Malaya to New York and from there by plane to the island of St. Lucia in the British West Indies. Only two fish died during the whole long journey.^{9, 10}

TIMETABLE OF THE TRAVELS OF *Tilapia mossambica*

Introduced in	Coming from	Time
Java*	?	? 2, 3 †
Sumatra	Java	? 3
Bali, Indonesia	Java	1941 24
Lombok, Indonesia	Java	1941 24
Malaya*	Java	1943 ? 12, 25
The Celebes	Java	1944 24
Taiwan*	Java	1946 15
The Moluccas	Java	1949 24
St. Lucia, B.W.I.*	Malaya	1949 9, 10
Thailand*	Malaya	1949 16
Trinidad	St. Lucia	1949 9, 10, 26
Grenada, B.W.I.*	St. Lucia	1949 10
West Borneo	Java	1950 3, 27
East Borneo	Java	1950 3, 27
Amboina, Moluccas	Java	1950 3, 27
Banka, Indonesia	Java	1950 3
The Philippines*	Thailand	1950 18
Jamaica, B.W.I.*	St. Lucia	1950 9, 10, 28
Barbados, B.W.I.	St. Lucia	1950 ? 9, 10
Dominica, B.W.I.	St. Lucia	1950 ? 9, 10
Martinique	St. Lucia	1950 ? 9, 10
Sabang, Pakistan	Java	1951 3, 29
Ceylon	Malaya	1951 30
Haiti*	Jamaica	1951 15, 31
North Borneo	Malaya	1951-2 ? 32
Hawaii	Malaya	1952 11, 21
Dominican Republic	Haiti	1953 20
Travancore-Cochin, India	Malaya	1953 23

* Countries in which the fish has become established in the wild.
† Authority, listed in "References" at end of article.

In their new home, two-thirds of the way around the earth from their native waters, the *Tilapia* multiplied prodigiously. Soon there were enough to be transplanted to five other West Indian islands and to Trinidad. In St. Lucia and Granada, specimens were deliberately allowed to take up existence in the wild; but in Jamaica, the fish accidentally got into one of the rivers and established themselves. In 1951, *Tilapia* from Jamaica were introduced into Haiti as part of an extensive fisheries development program of the FAO. Within two years they had become a favorite of the people and had been successfully planted in several rivers as well as a brackish water lake.^{19, 20} Before the coming of the *Tilapia*, Haiti had no freshwater fisheries to speak of, and

this lack was keenly felt because the density of population per acre of arable land in that country is one of the highest in the world. To make matters worse, Haitians have little or no experience in either fishing or fish culturing. Once again the superiority of *Tilapia*, which require so little care, has been established. Because of its success in Haiti, the fish has recently been introduced by the FAO into the neighboring Dominican Republic.²⁰

The reason for bringing the *Tilapia* to the Hawaiian Islands was quite different from those that had previously brought about its widespread transplantation. What was wanted in Hawaii was a cheap yet hardy bait fish for tuna fishing, which is one of the most lucrative of all our fisheries. It soon became apparent, however, that *Tilapia* would prove to be a popular food fish, and so specimens have recently been planted in various Hawaiian waters, especially with an eye to rehabilitating the brackish water fishery which has been on the decline for many years.²¹

From all that has gone before, it might seem that the *Tilapia* is, indeed, the perfect pond fish and that it alone could provide food for the world's undernourished millions. By the very nature of things this is manifestly untrue. Nevertheless some people have been so carried away by what has already been achieved with the fish that they have proposed some extravagant schemes quite beyond the creature's capabilities. For one thing, *Tilapia* is a strictly tropical fish and is definitely sensitive to cold.^{12, 14} For this reason, if no other, the plans to introduce this species into the Everglades as a food fish or into ditches in Oregon to control algae are impractical.

Another of *Tilapia*'s gravest shortcomings is, strangely enough, associated with one of its most desirable attributes. The fish will spawn almost anywhere at any time, but under the conditions usually prevailing in ponds, it also commences to reproduce at a very young age and therefore small size. It is an unfortunate fact that the fish grows very slowly from the time it begins to raise young — all its energies being diverted to reproduction, as it were. The result of this sexual precociousness is a pond containing a tremendous number of fish but with the great majority of them less than six inches long, a size considerably less than the fourteen-inch maximum at-

tained in nature. There is no great disadvantage to this if you, like many Orientals, prefer to fry your fish whole, scales, fins and all, or to cut them up into chunks for stewing or to make fish paste out of them. But if you are bothered by the bones and want to filet your fish or if you want to gut them, scale them and cook them in one piece, Tilapia nearly ten inches long are needed.

The tendency of Tilapia to become stunted when cultured in ponds seems to be the principal reason why this fish does not yet appear regularly in West Indian markets, even though it has contributed significantly to the diet of the poor. West Indians, as a rule, want sizeable fish for their table, although in this regard the Haitians are a notable exception. Experiments are at present under way in St. Lucia, Trinidad and Jamaica to determine the best method of overcoming the "runting" of Tilapia, as it is called. One method is to rear the sexes separately. Although young males and females look very much alike, a simple way of telling them apart has been discovered. It has also been found that males grow faster and get larger than females, even when the latter are relieved of the trying task of incubating their eggs and young. Perhaps the answer to the problem of "runting" will be to rear male Tilapia of genetic strains specially selected for fast growth by themselves in ponds that have been properly fertilized to provide plenty of food for them.⁹

Experiments with Tilapia to explore its potentialities and to improve methods of culturing it are also being carried out in Malaya, Thailand, the Philippines, Ceylon, Hawii and South Africa. At the Alabama Polytechnic Institute the possibility of employing the fish in ponds in the warmer parts of the United States is being studied.²² After long discussion pro and con, Tilapia have finally been brought to India.²³

In Java, where the Tilapia first came into its own, it no longer occupies first place among pond fishes. Once again the Milkfish, whose light color makes it more marketable, is the most important species. Nevertheless, the Tilapia ranks second or third in total number of pounds produced, and it has been estimated that the introduction of this species into Java has added some 5,500 tons to the annual production of fish on that island.²⁴

Pak Mudjair, whose discovery of the Tilapia started the fish on its Odyssey, has had a street in the western Javanese town of Bandung named after him, but his greatest satisfaction must come from the knowledge that his fish now thrives in tens or perhaps hundreds of thousands of ponds and other bodies of water and that it provides an enormous number of people with food. It is true that the Tilapia has not lived up to all expectations, but no real creature could have done all that the publicity agents and incorrigible optimists claimed for it. Suffice it to point out that man seems to have acquired another domestic animal to help him on his way.

REFERENCES

1. Barnard, *Ann. South African Mus.*, 36 (2) : 111, 1943. Barnard, "A Pictorial Guide to South African Fishes," Maskew Miller, Cape Town, 1947. Barnard, Rpt. Inland Fish. Dept., Cape of Good Hope, (5) : 48-61, 1949. Hey, *Ibid.*, (7) : 17-19, 1951. Jubbs, *Rhodesia Agric. Jour.*, 49 (2) : 69-73, 1952.
2. Schuster, *Spec. Pub. Indo-Pacific Fish. Council*, (1) : 94-96; 103-107, 1952.
3. Vaas & Hofstede, *Contr. Inland Fish. Res. Stations Djakarta-Bogor Indonesia*, (1) : 68 pp., 1952.
4. Hofstede, *Proc. U.N. Sci. Conf. on Conserv. & Utiliz. Resources 1949*, 7 : 136-138, 1951.
5. Sutan Larangan, *Spec. Pub. Indo-Pacific Fish Council*, (2) : 41-43, 1953.
6. Hofstede & Botke, *Landbouw* [Bogor, Java], 22 (10/12) : 453-468, 1950.
7. Baerends & Baerends-van Roon, *Behaviour*, Suppl. (1) : 243 pp., 1950.
8. de Zylva, Adm. Rpt. Act'g Dir. Fish. Ceylon 1952, p. 21, 1953.
9. Hickling, personal communication.
10. Schouten, *in litt.*
11. Brock, *Copeia*, 1954 (1) : 72, 1954. Atz, *Aquarium Jour.*, 24 (12) : 290-296, 1953.
12. le Mare, Rpt. Fish. Dept. Malaya 1949 : 62-68, 1950.
13. Hey, "The Culture of Freshwater Fish in South Africa." Cape Town, 1947.
14. Hey, Rpt. Inland Fish. Dept., Cape of Good Hope, (7) : 18, 1951.
15. Lin, *in litt.*
16. Ling, *in litt.*
17. *FAO Fish. Bull.*, 6 (6) : 223-229, 1953.
18. Villadolid, *in litt.*
19. Lin, *Proc. Gulf and Caribbean Fish. Inst.*, (4) : 110-117, 1951.
20. *FAO Fish. Bull.*, 6 (6) : 230-233, 1953; 7 (1) : 35-36, 1954.
21. Brock, *in litt.* Brock, Biennial Rpt. Bd. Comm. Agric. & Forestry T.H. 1952 : 114-123.
22. Swingle, *in litt.*
23. Hora, *Sci. and Culture*, 17 (2) : 94-95, 1951. Anon., Ann. Adm. Rpt. Dept. Fish Bombay 1952-53 : 31, 1954. Anon., *Proc. 5th Meeting Indo-Pacific Fish. Council*, Sect. I : 9-10, 1954. John C., Mary, personal communication.
24. Schuster, *Proc. 3rd Meeting, Indo-Pacific Fish. Council*, Sect. II & III : 187-196, 1952.
25. Sugars, *The Aquarium*, 17 (9) : 192-193, 1948. Edmead, *Aquarist and Pondkeeper*, 19 (4) : 93, 1954.
26. Kenny, *in litt.*
27. Vaas, *Proc. 3rd Meeting, Indo-Pacific Fish. Council*, Sect. II & III : 119-128, 1952.
28. Director of Agriculture, Jamaica, *in litt.*
29. Jones & Sarojini, *Jour. Bombay Nat. Hist. Soc.*, 50 (3) : 594-609, 1952.
30. de Zylva, Adm. Rpt. Act'g Dir. Fish. Ceylon 1951, p. 21, 1952. Anon., *FAO Fish Bull.*, 5 (3/4) : 137-138, 1952. de Zylva, *Jour. Bombay Nat. Hist. Soc.*, 52 (1) : 142-148, 1954.
31. *FAO Fish. Bull.*, 5 (1) : 28, 1952; 6 (6) : 230, 1953.
32. Job, *Proc. 4th Meeting Indo-Pacific Fish. Council*, Sect. I : 71, 1952.

A Collector Tells

How to Capture Ant-thrushes

ANYONE POKING AROUND in the backyard of the tropical Americas will soon become acquainted with a variety of ants. Not scientifically, perhaps, but very, very personally. I do not know the technical name of a single ant, but I know too well the behavior of the so-called fire-ants that inflict intolerable burns, the inch-long black ants that sting like hornets and the destructive leaf-carrying ants that can do away with a hundred-pound mound of husked corn in a single night.

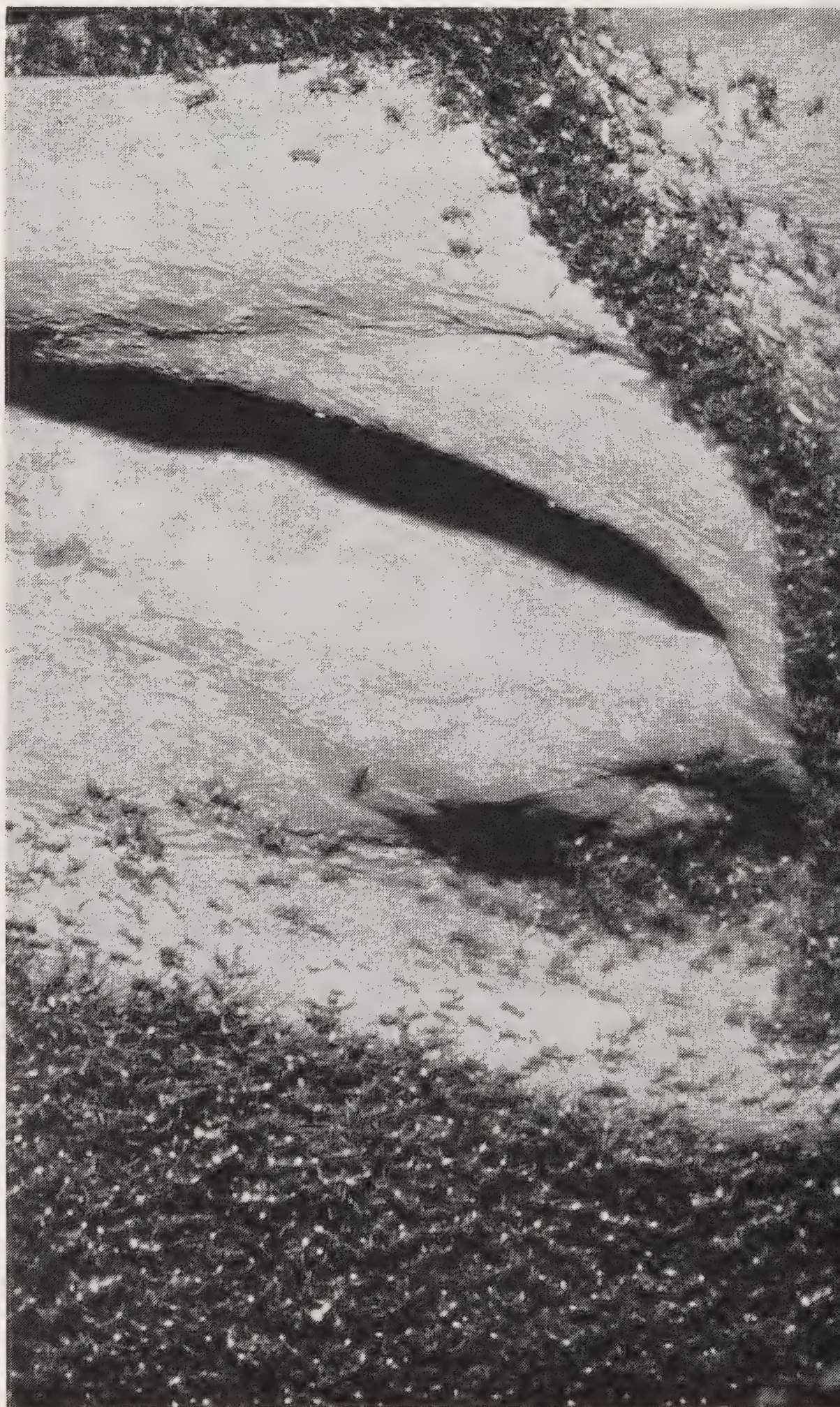
All these ants are just routine, however; you accept them the way you accept biting flies, mosquitoes, thorns, *bête-rouge* and muddy drinking water. If your job is to collect birds, as mine was during about a year in the Guianas of South America, you are professionally concerned only with one kind of ant — the army ants that swarm in long, broad and destructive columns during certain seasons of the year. These ants you seek out because where they are on the move, there you are likely to be able to capture the Ant-thrushes that feed on insect small game dislodged by the columns.

It took me about eight months to find truly large agglomerations of army ants, but after the first encounter other swarms were met with fairly often and it became evident that the dry season, roughly from the middle of July to the end of December, is the time when they are in motion. Unfortunately, the only place where I found the ants and the Ant-thrushes was in country about the most disagreeable of any spot in the Guianas, which are full of disagreeable spots.

For all of eight months I had been roaming widely over British, French and Dutch Guiana, always keeping an eye open for army ants, but never finding any of the big columns on the move. I suppose it was on account of the season, but I do not know enough about the habits of

army ants to be sure. At any rate, when I did find them, it was some thirty miles up the Maroni River in French Guiana, in tide-inundated forest.

Here the going is tough. Twice a day the river overflows its banks and creates a muddy swamp, slimy, slippery and virtually impassable, among the interlaced roots of tall trees. This broad tidal swamp swirls around islands of higher ground,



By
**CHARLES
CORDIER**

*Formerly Collector for
The New York Zoological Park*

IGHT—One of the prizes, a
white-barred Ant-thrush. **BE-**
W—A column of *Eciton bur-*
elli, the swarm-raiding army
ant, emigrating at night from the
antony bivouac after a day's raid.

Photo by T. C. Schneirla



and here the collecting is often quite good — once you have crossed the swamp. The tide-created islands are clothed in virgin forest, tall and straight. Epiphytes, bromeliads, lianas, the usual clutter of parasitic vegetation, are almost nonexistent and the forest floor is reasonably open except for the low bush growing under the sheltering tall trees.

I was camped near one of these islands one day when one of my two Indian helpers came in with a report that the army ants were swarming. It was a situation I was well prepared to meet, for in expectation of someday encountering Ant-thrushes at work I always carried a roll of suitable nets.

Sure enough, not far from the camp, we found the head of a black column of ants. I wish I knew how long the column was, and how wide the foraging head; all I know is that I had the impression that the head was several hundred feet wide. That may be a wild exaggeration, for it was at best an impression; I was immediately too busy to make a study of the ants for their own sakes.

As we came upon the column I stopped to listen and to study the direction of the advance.

At first the forest was as silent as I and my helpers, and then I began to hear a soft drizzling sound, almost like a light rain. I am not sure what caused it. Possibly it was the disturbance of the dry leaves by the "tramping" of millions of tiny ant feet; perhaps partly it was caused by insects in the path of the ants scurrying, flying, leaping to escape destruction. As I say, I am no specialist in ants. I did not, however, see any considerable number of insects making off in advance of the column.

The ants were thorough. In their direct path, every bush and every tree was climbed and explored. While I watched only two creatures fell prey to them. A black scorpion, whose presence in the forest I had never suspected, suddenly scrambled out from under matted leaves. Its back was literally alive with baby scorpions. It darted this way and that, as if confused, and in a few seconds it had crossed the path of a living tendril of ants and some of them climbed aboard. More joined the attack, and in half a minute more the scorpion and her brood were overpowered and smothered under ants.

The only other victim I saw was a very large earthworm of a kind considered dangerous by the local Indians. With vigorous and snake-like whipping motions it managed to get free of the first few ants that attacked it; it actually wriggled convulsively quite out of the path. Then it kept on wriggling without any sense of direction and snapped itself back directly into the path. It, too, was almost instantly blanketed.

There may have been plenty more casualties of this kind, but my attention was switched suddenly by a tinkling laugh a little way ahead, a laughing sound that was caught up and repeated from half a dozen bushes. The Ant-thrushes had arrived and were "hawking" in swift, darting flights after insects. The "laughter" call was being made by Rufous-throated Ant-thrushes, one after another taking up the note and passing it on, so that it seemed to come now from this direction, now from that.

And then the forest came alive with another sound, a low, whistled *pseeouw*, picked up from one bush after another. This was the White-fronted Ant-thrush, and every few seconds one of these handsome birds would streak down from a twig, seize an insect out of the very front rank

of the ant column, and dash back up to safety. In the gloom of the forest I could not tell how many of the birds were present, but their whistling sounds seemed to come from every direction and there could have been as many as a hundred in the immediate neighborhood.

The older books on ornithology call the Ant-thrush the "Nemesis" of the army ants and state that they actually feed on the ants. This seems to me rather unlikely. As nearly as I could tell by observation, the birds were feeding solely on insects dislodged by the foraging column, and indeed they were forever on the move alongside and ahead of the head of the column. If they wanted ants and nothing else, they might easily



station themselves at any point alongside the column and pick the ants off at their leisure, just as chickens do when they encounter a column of leaf-cutting ants in the daytime.

AFTER STANDING ASIDE from the column and studying its direction and speed and the movements of the Ant-thrushes, I was ready to go to work. My helpers and I strung silk pocket-nets between bushes a few feet ahead of the ants, working swiftly and swinging the nets so that they cleared the ground by only a couple of feet.



A low, whistled "pseeouw" indicates that the White-fronted Ant-thrush has arrived on the scene.

The Black-crested Ant-thrush is a perky, handsome species. Only adult males have a black crest.

Cordier also brought back a Great Ant-thrush, a species have not previously shown.

Then we repeated the process a hundred yards further on, in the direction the ants were moving.

By the time the second series of nets was in place and I had hurried back to the first ones, the ants had caught up with it and I beheld the gratifying spectacle of six White-fronted Ant-thrushes caught in one net only seven feet square. Some were hanging so low they were almost touching the scurrying black stream below. The other nets held two or three birds each.

It was a gratifying spectacle, all right, after eight months of waiting for just such a sight, but there still remained the job of getting the birds before the ants started climbing the bush and the net. My helpers were fully competent to take birds out of nets with care and dispatch, but this time they held back. I cannot really blame them, for they were barefooted and barelegged, of course, and the prospect of standing for only a few moments in the middle of that column of

ants to work at the nets was not inviting. However, I did have shoes on, and so I ran in, extricated the birds and passed them to the helpers beyond the column. Shoes or no shoes, it required on my part a certain amount of the stoicism which is supposed to be traditional with Indians, but which seldom is.

The birds removed, I unfastened the nets at the first set and rushed ahead to the forward nets. Here, again, the pockets were sagging with captured Ant-thrushes, even though the ants had not



yet arrived. The removal of those particular birds was a great deal more leisurely and comfortable.

Altogether, I caught 18 White-fronted Ant-thrushes and 5 Rufous-throated Ant-thrushes, directly as a result of the passage of this one column of army ants. As nearly as I could tell, I had made no appreciable diminution in the number of the birds darting around the area in their efforts to feast on insects.

In the next week I came many times almost to regret having captured the birds, for they took an unbelievable amount of care and attention. Every one had to be hand fed for at least five days as I tried to get them accustomed to mealworms, first, and then the prepared food that is customarily used for insectivorous birds. They did, after a time, learn to know and like civilized food. Consequently the New York Zoological Park was enabled to have a very pretty exhibit of Ant-thrushes.

News from the Conservation Foundation

Mr. Osborn to Address Meeting of American Chemical Society

At the October meeting of the American Chemical Society in New York, Mr. Osborn will speak about the national water situation and about the need for more public understanding and action regarding it. The meeting will be composed largely of scientists and manufacturers in the chemical industry, which uses vast quantities of water in processing.

Our National Parks

A difficult policy decision faces the Secretary of the Interior with reference to the National Parks. Because of population growth in urban areas in the West, pressure is increasing to develop the National Parks along the lines of recreational facilities, mountain tramways, roads, ski-lifts, hotels, dance halls and other popular resort accommodations. Federal funds are most easily obtained for those public areas which have the greatest mass use. But the Foundation and the National Park Service believe, as a matter of policy, that the kind of recreational values for which the Parks were established — enjoyment of wilderness and scenic beauty — can be destroyed by mass resort development.

Report on Conservation Workshop

A brief but exciting report on the experimental Pilot Program of the Plymouth, N. H., High School Conservation Workshop has just been issued and is now available from the Foundation on request. The Workshop was sponsored by the Foundation in 1951 to see how far conservation teaching might be directly integrated in all regular high school subjects. The entire teaching staff at Plymouth shared in the planning and development of the program. It is hoped that other schools will be encouraged to sponsor similar methods of making teachers and their students aware of their natural environment and of their dependence on its resources.

More About "The Making of the River"

Acting on the advice of Clement Perry, associated with a chain of small art theatres in the East, the "River" is being enlarged to 35 mm. proportions for potential Arts Theatre bookings early next year in New York City. The "River" has already been purchased by Coronet Instructional Films, which is bringing it out for the 16 mm. market this fall. We have also been informed by the chairman of the Motion Picture Division of the Photographic Society of America that the "River" has won Honorable Mention in the Professional Film Class of its annual contest.

Climatologic Data

Americans have now come to use four times as much water as they did in 1900. It is this extraordinary increase which is the reason for a Foundation study of water data. This will explore what we still need to know in the way of basic hydrologic and climatologic information in order to conserve the country's water resources most efficiently. It will deal with such questions as the number of stream measurements and rain gauges that will be needed for adequate measurements of water supply, use and waste. These basic data are clearly indispensable for future development and control of water supplies and to promote intelligent action in this vital field.

Eastern Water Laws

A second new study will deal with legal problems that have recently come to the fore in many states in the eastern United States with the vast increase in water use. Conflicts over the right to use water have become much more frequent and some extensive revision of the laws governing water rights and use is in the offing in many states. The study will endeavor to provide background for state action through analysis of past experience with various water-law doctrines.

Proposed TV Program

The Audio-Visual Department of the Foundation is working on a program tentatively identified as the "Weather Show," aimed at one of the major networks sometime in the near future. Associated with us in this enterprise are Mr. Ernest J. Christie, Chief of the U. S. Weather Bureau in New York City, and Mr. Vernon Crudge of the Muntalp Foundation. Indications are that this show, using stills, motion pictures and charts emphasizing the influence of weather on resources, may be the first weather show in color on the air when color television comes into general use.

The "Shorts" Come Home At Last

"The Elementary Conservation Series" has been purchased by Encyclopaedia Britannica Films, Inc., for fall distribution and will be publicized by specially designed "flyers" mailed to 15,000 science teachers throughout the United States. For the first time EBF has made up Teachers' Guides in color to go with the films.

Special showings of these films have already been held at the National Education Association Conference, June 25-July 12; Teachers' College, Columbia University, August 2-6; Garden Club of America, August 16-19; New York University Summer Session. Requests for future showings have been received from Boston University and the Conservation Education Conference in New Haven.

Part III of the "Elementary Conservation Series," "The Forest," has been requested by the Public Affairs and Special Events Department of CBS for transmission over the network this fall.

Participation in TV Film Project

The Foundation has agreed to participate with Thomas Craven Productions on the creation of twenty-six 15-minute conservation and nature films to be made available to 400-odd TV stations throughout the country. These films, which will include some of the best of John Storer's photography, familiar to New York Zoological Society members, will be known as "The Web of Life."

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Nigrelli Aids the State in Weakfish Problem

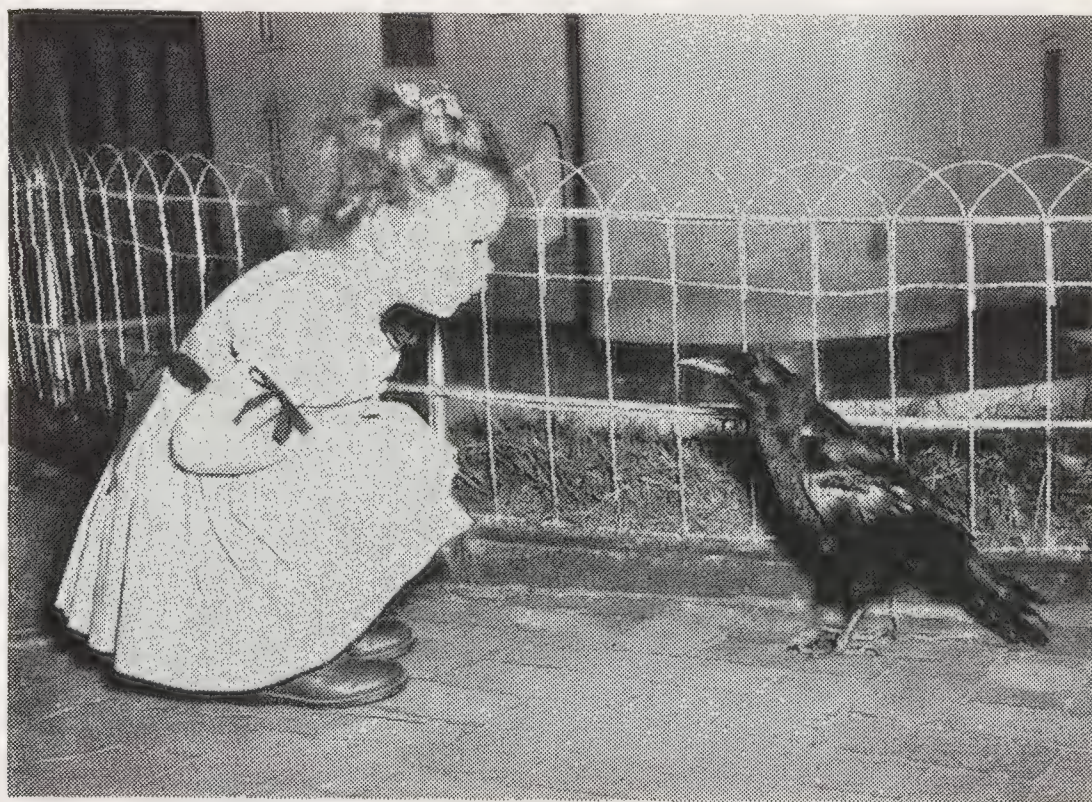
Dr. Ross F. Nigrelli, the Aquarium's pathologist, is currently engaged in a study of parasites and diseases of the Weakfish, a popular food and game fish which has been showing a decline along the Atlantic Coast.

The falling off in numbers of the fish is so serious that a series of Federal-and-State-supported research projects has been set up. Dr. Nigrelli is working with the New York State Department of Conservation.

Deacon Is No More

Deacon, the talking Eastern Crow that has been an attraction of the Children's Zoo since 1941, died in late summer at an age of about 14½ years. Two "understudies" have been pre-

sented by friends of the Society but as yet have not matched Deacon in friendliness and willingness to talk.



This photograph of Deacon and a young visitor was typical of a scene repeated many times. The crow was irresistible to children.



These nine cartoon posters, drawn by Donald T. Carlisle, have been put up all around the Zoological Park and seem to have a good effect in reducing the amount of litter left by visitors.

How the Sapphire Mink Came to the Zoo

The Sapphire Mink pictured on page 146 was captured 56 miles from New York City, in Putnam County. It is, properly, not a "wild" Mink, the color phase known as "Sapphire" being an established mutant cherished in the fur trade and usually reared in captivity on "Mink Ranches." Our specimen presumably was a fugitive from a Mink Ranch.

The animal was presented to us by Herman Forster, Deputy Commissioner of the Department of Water Supply, Gas & Electricity, who captured it at a fishing camp between Dyckman and Towners, N. Y. It was first seen one morning when it came out of a stand of oak and tulip trees, approaching the center of the camp where hamburgers were being cooked on an open-air

grill. Mr. Forster happened to have beside him a basket of chicken heads being used as bait for Snapping Turtles, and he tossed one to the animal. It bounded off into the woods with the delicacy, returning in about 20 minutes for another. On its third appearance, Mr. Forster was ready with a landing net which he threw over the animal as it came up to take the food.

The Sapphire Mink is now on exhibition in the Small Mammal House.

He Got a Return of 47.14% On the Investment

Small accidents occur in the Zoological Park from time to time and generally are handled expertly by the Registered Nurse on our staff. In late summer, however, a different kind of accident called for the special abilities of Comp-

troller Herbert Schiemann. Dolly, one of our Asiatic Elephants, seized and began to chew a handbag that happened to be in the hand of a little girl who was offering food to the animal.

Since the case involved money, the Comptroller was summoned. The handbag was said to contain \$2.80 in paper money and coins, and the paper money and the handbag itself had disappeared down Dolly's throat by the time the Comptroller arrived. He did, nevertheless, manage with the help of a keeper to salvage \$1.32 in coins — a return of 47.14% on the child's investment in elephant nutrition.

Twins Born to Lorises

Twins were born to a pair of Slow Lorises in the Small Mammal House on September 6, apparently the first twins recorded for these lowly Primates. The father is a Gray Slow Loris X Malayan Slow Loris hybrid (*Nycticebus coucang cinereus* X *Nycticebus coucang coucang*) and the mother is a Gray Slow Loris (*Nycticebus coucang cinereus*). Their first offspring, which shares their compartment, was born on April 9, 1951. The father of the twins was himself born in the Zoological Park. — W. Bridges.

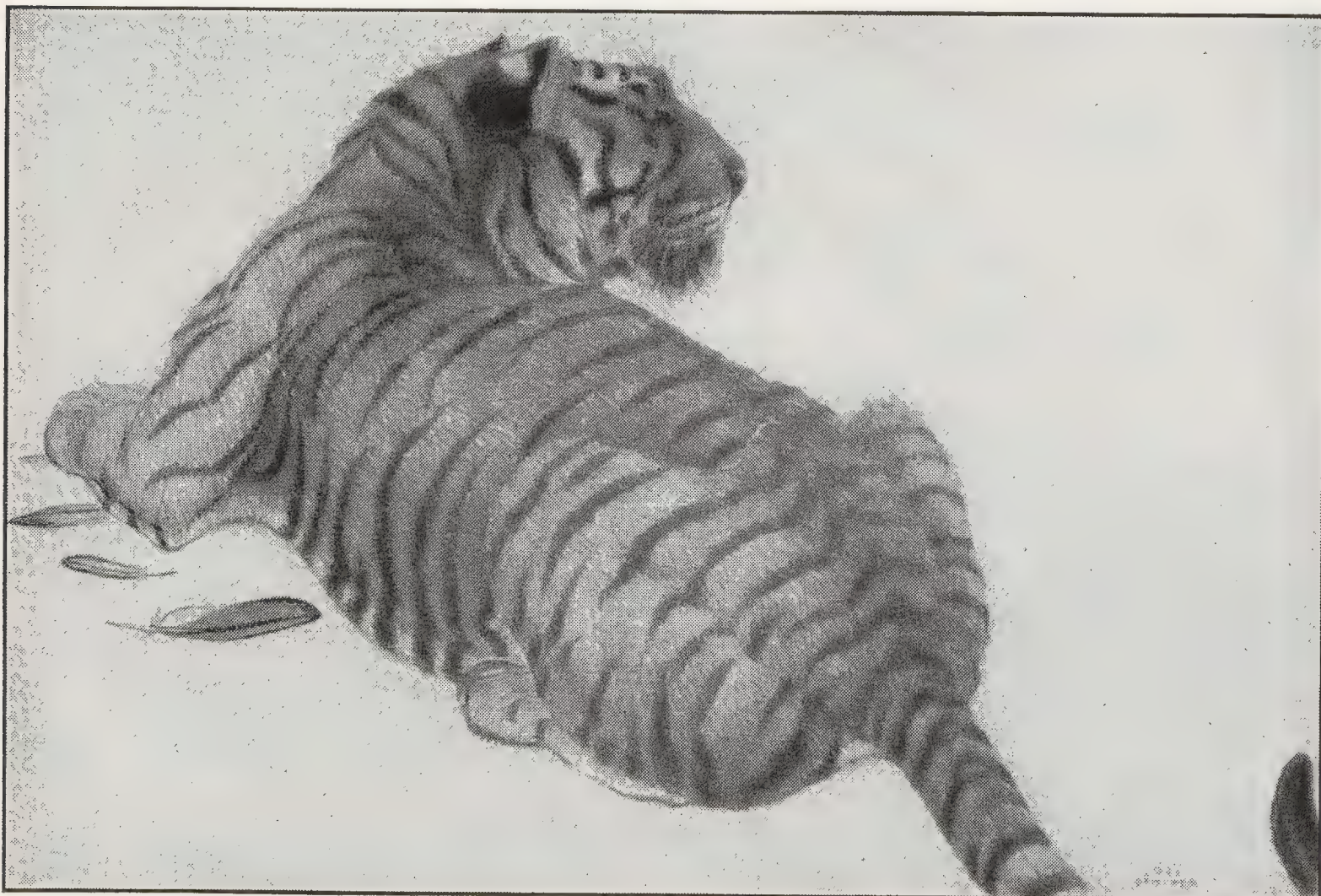
Oka Levels Off Around 300 Pounds

Oka, our largest female Lowland Gorilla, has apparently reached her normal maximum weight at about 300 pounds. She attained the exact weight of 300 pounds in August, 1950, climbed to 318 pounds in April of 1951, slipped back to

270 pounds in July of 1952, and her August weight this year was again an even 300 pounds as recorded on the platform scales built into her compartment in the Great Apes House. Oka came to us on September 7, 1941, when she was about three years old and weighed 20 pounds. — W. Bridges.

Zoological Park Miscellany

The numbers of tropical fish "fanciers" is never so strongly realized by the Aquarium staff as when interesting small fish are put on exhibition. Then attendants and the staff are likely to be besieged by visitors wanting to know where they can get similar specimens. Recently when the Aquarium put on exhibition seven specimens of three species of East Indian coral reef fishes — Clownfish, Three-spotted Damsel Fish and the Coral Beauty — the inquiries were so numerous that a special label was put up, explaining that these are marine fish and not suitable for the ordinary home aquarium . . . When Heart Lake, near the Zebra House, was drained routinely this summer, a number of specimens of Banded Killifish were found. This fish, scientifically known as *Fundulus diaphanus*, is a fresh-water relative of the Common Killifish or Mummichog. The lake has been drained many times in recent years but this is the first time Banded Killifish were encountered; presumably caught elsewhere in the area and "planted" in Heart Lake by some passing fisherman . . . A Northern Bald Eagle captured in Alaska and presented to us by Dr. Oshin



A drawing in crayon from an exhibition of animal art by Joel Stolper in the Heads & Horns Museum in the Zoological Park. Some 30 drawings and paintings are in the current show.

Agathon has finally learned to eat "civilized" food. For the first five days after the bird arrived it steadfastly refused to touch mackerel, butterfish, mice or horsemeat. In desperation Head-keeper of Birds Scott bought a pound of fresh salmon and offered it to the bird; it took the salmon instantly. The next day Mr. Scott offered butterfish and the eagle ate them, its reluctance to eat apparently ended. It has since been feeding regularly on butterfish and horsemeat . . . One hundred and twenty members of the American Psychological Association, in New York for a meeting at the beginning of September, visited the Zoological Park on September 4 and saw demonstrations of our own work in animal behavior.

PUBLICATIONS OF INTEREST

BUFO — The Story of a Toad. Written and illustrated by Robert M. McClung. 48 pp., numerous black and white, as well as colored illustrations. Morrow Junior Books, William Morrow & Co., Inc., New York, 1954. \$2.00.

Few authors of natural history books for children would consider writing a story with an amphibian as the subject. Even fewer would be able to produce a scientifically sound, pleasingly readable account. This interestingly-told story of the life of Bufo the toad, by Mr. McClung, our Curator of Mammals and Birds, is both of these, and the drawings — some in three colors — give the book an attractive appearance. As in his preceding books, the author follows the activities of his subject through the changing seasons and across the years to adult life. The story is indeed both educational and entertaining. — J.A.O.

ZOO EXPEDITIONS. By William Bridges. Seventy photographs in black and white. 191 pp. William Morrow & Co., N. Y., 1954. \$3.50.

In this absorbing volume, our Curator of Publications has recorded in detail the events of various expeditions

in the interests of the Zoological Society. They cover many parts of the globe and many fields of interest: blind fishes in Mexico, frogs and toads in Trinidad, an ancient tortoise in New England, elephants and Congo Peacocks in Africa, birds in the tropics of America, sea turtles on Florida sands. All but one are author-participation accounts, factually and emotionally firsthand. Certainly, younger readers will be more than ever convinced of the fascination of zoo expeditions, adding greatly to the burdens of zoo administrators who must continue to attempt to dissuade them. — L.S.C.

THE MAMMAL GUIDE. Mammals of North America north of Mexico. By Ralph S. Palmer. Illus. by author, 40 plates in color, 37 line drawings and 145 maps. 384 pp. Doubleday & Co., Inc., Garden City, N. Y., 1954. \$4.95.

This useful little volume varies from the usual course of "field books," for in addition to descriptions and distributional maps, it offers compact outlines of general behavior, reproduction and conservation. Much information not easily come by, such as weights, gestation periods and longevity in captivity, is included. This reviewer, at least, would have been grateful for source references for many of these data, although it must be admitted that their inclusion would have meant a considerably larger volume. Dr. Palmer's color drawings are excellently done and well reproduced. — L.S.C.

ANIMAL CONTROL IN FIELD, FARM AND FOREST. By W. Robert Eadie. The Macmillan Co., New York, 1954. 257 pp. \$3.75.

For better understanding of the somewhat enigmatic title of Dr. Eadie's book, the jacket carries a line of explanation: "A comprehensive, practical guide to the control of injurious animals." If "animals" is understood to refer to "mammals," the nature of the content becomes quite clear. For not only are the predatory species adequately covered but many non-carnivores, such as rodents, rabbits and deer are included. Factual material for each species or group is given under the sub-heads of identification and habits, economic status, control and natural enemies. The controversial questions of how, when and where control measures should be undertaken or if they should be undertaken at all, are considered fairly and sensibly. In many cases, protection for threatened objectives is recommended rather than destruction of the aggressive species. When the latter action is indicated, full directions for procedure are given. Altogether, Dr. Eadie's book seems to be the most comprehensive and useful one so far produced in this prolific field. — L.S.C.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1954)

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*You mislaid your BILL?
Seems unlikely!*

Yet it's something that can happen to anybody. Even some of the best friends of the New York Zoological Society sometimes forget their dues for a month or so — just because they tucked our notice off in some cubby-hole for future reference and then fared forth for the summer!

Now that summer's over and you're back in town, better check to see if you've mislaid our little missive. Many exciting things are in the offing which you and your family will not want to miss.

IMPORTANT! If you have changed your address this fall, please let us know.

MEMBERSHIP DEPARTMENT
New York Zoological Society
30 East 40th Street
New York 16, N. Y.

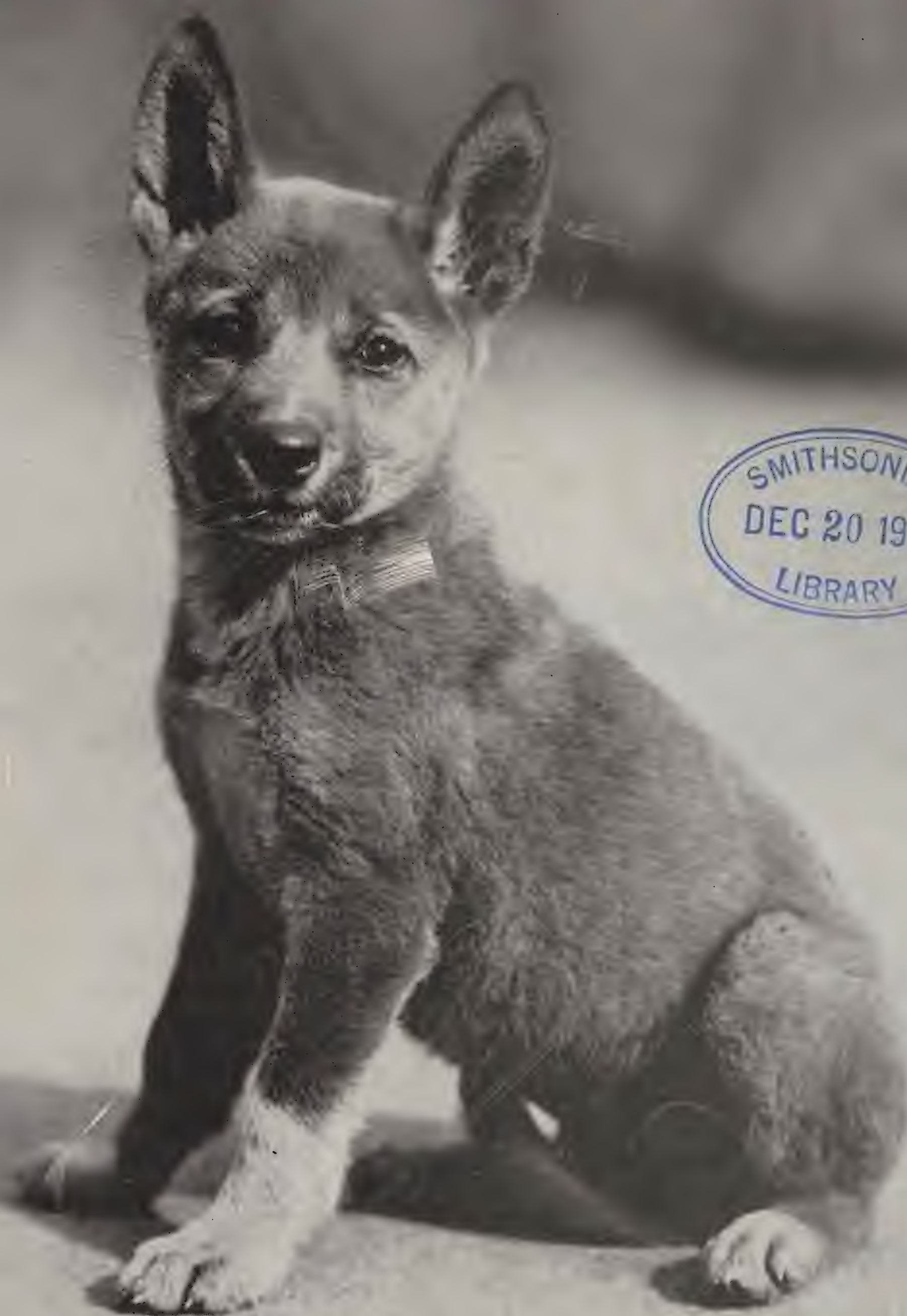
S. O. S.:

WE NEED NEW MEMBERS!

Please send us the names of your best prospects on the post card bound into this magazine. We will send them invitations to join, and full information about membership in your Society.



ANIMAL KINGDOM



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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Odyssey of Money

EARLIER IN THE YEAR I set myself the task of writing a series of brief editorials to illustrate ways in which our Society uses its funds. This is the last of the series. I cannot feel it has been a really successful effort. The difficulty of translating certain values into written words seems too great.

Admittedly the principal purpose of these editorials has been to encourage substantial gifts and legacies to our institution. We are failing to meet many superb opportunities solely because of lack of sufficient financial strength. We seem to have acquired the reputation of being "well off" because, in the main, we live within our income. In a sense this imposes a "cruel form of parsimony," not literally, of course, but in the sense that we must turn our faces from roads leading to finer accomplishment. We have a four-fold destiny:

Greater service to the public

Greater contributions to scientific knowledge

Greater activity in education

Greater results in wildlife protection

(All the while we need to be in a position to take better care of our employees' interests for, after all, those who work for our Society make it what it is)

From a social or philosophical point of view the separation of people from the living things of the natural world is a disturbing phenomenon of the modern age. One is justified in having deep concern regarding the ill effects of this situation upon human society. The impact upon the human spirit of an urbanized and mechanistic age must have its antidotes. None is more effective than the work and influence of our Zoological Society.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

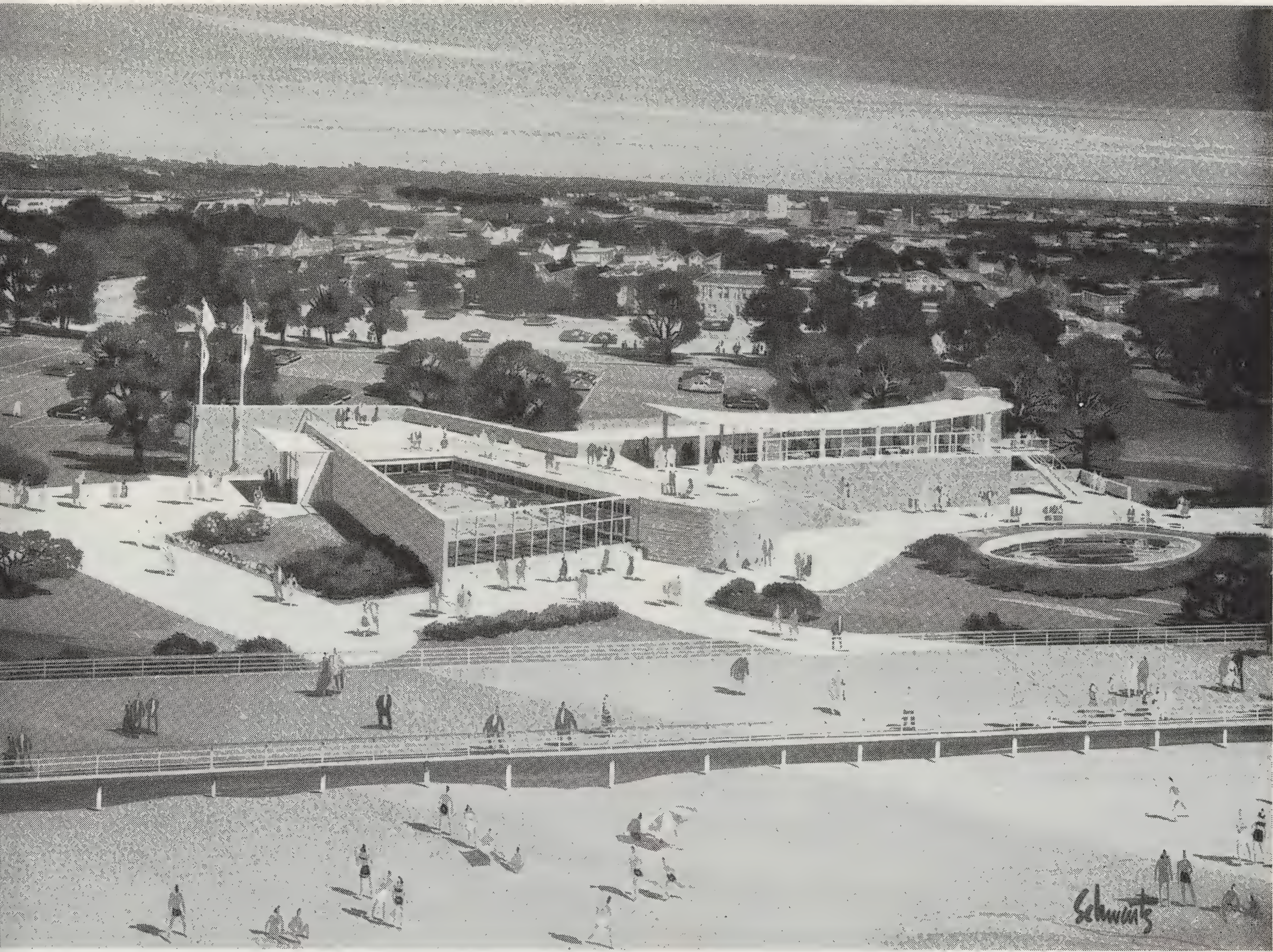
THE NEW AQUARIUM IS OFFICIALLY BORN

By FAIRFIELD OSBORN

TIME MOVES ON. At 4:14 o'clock on the afternoon of Sunday, October 24, the new Aquarium was officially born at a groundbreaking ceremony on the twelve-acre site at Seaside Park, Coney Island. At 8 o'clock the following morning bulldozers and trucks, all the heavy machinery of construction, moved in. This greatly-needed public institution is at last being built; it will bring to the people of New York City, as well as to visitors from all over the United States, dramatic exhibitions of the living things that inhabit the lakes, rivers and oceans of the world. If all goes well it will open its doors to the public in the spring of 1956.

In this mechanized age, when two-thirds of our people live in cities or large towns, a public Aquarium such as this serves as a gate through the "iron curtain" that separates people from the wonders of the natural world. The constant de-





STAGE ONE OF THE NEW AQUARIUM IN ITS PARK-LIKE SETTING

THE GROUND-BREAKERS:

TO RIGHT: Laurance S. Rockefeller, Chairman of the Executive Committee of the Society; Fairfield Osborn, President of the Society; Lawrence E. Gerosa, City Controller; John Cashmore, Brooklyn Borough President; Abe Stark, President of the City Council; Robert Moses, Park Commissioner; and Moe E. Silberman, President of Coney Island Chamber of Commerce. All spoke at the ceremony.

sire of people to experience the pleasure of seeing living animals, whether of the land or of the sea, is forcefully proved by the fact that today more than 50 million visitors a year go to public zoos and public aquariums in the United States. This means one out of three of our people — about one-third of our total population. No other kind of cultural or recreational institution even approaches this record as a magnet of public interest.

For more than thirteen years New York City has been the only large city in our country or in the Western World without an institution such as this. The old Aquarium at the Battery, closed

in 1941 because of the construction of the Battery-Brooklyn Tunnel, was visited by an average of 2,500,000 people each year. The second World War, the Korean War and their aftermaths, have blocked the mutual plans of the City and our Zoological Society to create a new Aquarium to take its place. But we are on our way at last.

I use the phrase “on our way” because the building and the associated facilities now being constructed represent the first stage of what I believe will be the most outstanding institution of its kind in the world. While it may take years to fulfill the entire plan, we expect that this initial stage will be a brilliant success in its own right, as well as a dramatic promise of the eventual completed building.

Stage One will be 216 feet long and 120 feet wide, with an exterior of limestone, glass brick and glazed panelling, accompanied by gardens, outdoor pools, restaurant service and a parking field. Perhaps the most exciting element will be



Cheerful confidence marked President Osborn's brief address at the ground-breaking.

a large outdoor oceanic tank providing over-water and under-water views of great sea mammals such as walruses, porpoises, seals and sea-otters. In the adjacent large indoor exhibition hall there will be three great tanks, beautifully decorated and illuminated, for sharks, rays, manatees, sea turtles and other denizens of the ocean, together with some 24 additional tanks for interesting species of fishes from the temperate and tropical zones. In the outdoor pools there will be exhibits of marine and aquatic birds — penguins, pelicans, flamingos and cormorants.

Our Society is tremendously interested in the plans which are now taking tangible form for the development and improvement of the entire area surrounding the new Aquarium. No great city anywhere has a finer physical possession than this region within our very City itself, bordering the ocean. Our City government fully recognizes the opportunity for making the area more beautiful and more useful, both for recreation and for living. The investments it has made in acquir-

ing the land for the new Aquarium and for other improvements are sure to be justified many times over. The vision of Park Commissioner Robert Moses as to what can be accomplished for this whole region is a wonderful thing for the future of New York.

Coney Island was, at one time, nothing to be proud of. Commissioner Moses himself stated the case in his remarks at the ground-breaking ceremony.

"It had become, when we took it over under the new Charter in 1937, a honky-tonk, catch-



Commissioner Moses: "Now comes the finest Aquarium in the world." He drew applause.

penny waterfront," he said. "We have condemned land, lifted the boardwalk and moved it back to add to the beach. We built the Belt Parkway. We foreclosed littered, tax-ridden plots on the boardwalk and turned them into playgrounds and parking spaces. We encouraged good residential building, including public housing. We are shrinking the amusement section to proper limits and getting rid of its worst manifestations.

"Now comes the finest Aquarium in the world, a tremendous attraction which no one visiting New York will skip, which will draw our own people again and again and which will be the pride and gathering place of the residents of the new Coney. This is a joint enterprise of the New York Zoological Society and the City. It represents private gifts and public money. It will be supervised by fine citizens and operated by experts. It is New York enterprise at its best."

As our Members perhaps know, Stage One of the new Aquarium will cost \$1,500,000, half of



which has been provided by the Society and half by the City of New York through the Board of Estimate. The total cost of the completed Aquarium — the great halls and facilities designed to be added to Stage One — will be many times this sum. Our great hope is that the success of Stage One will be so evident that there will be no long delay in proceeding to the final stage of completing this superb institution.

Why are we so confident of success, so determined to push on until the New York Aquarium takes its ultimate form? Laurance S. Rockefeller, speaking as Chairman of our Executive

Mr. Rockefeller expressed the reasons why an Aquarium is important to the youth of the city.

Committee at the ground-breaking ceremony, made our philosophy clear.

"Our youth, living so largely in the man-made environment of the city, are hungry for knowledge of life and its true meaning," he said. "Books and the classroom can go only so far in meeting this need. They are no substitute for learning from nature at first hand.

"We are fortunate in the opportunity provided for such experience by our parks and trees, the Hudson River, our beaches and the sea itself. However, the living animals and birds of our zoos and the fish and aquatic life of the Aquarium are an absolutely necessary part of the experience of knowing nature directly and in proper perspective.

"In this ceremony we do more than celebrate the start of just another unit in the city's extensive educational and recreational facilities. Actually the new Aquarium will provide a major link in the all too short chain of opportunities for our children and young people to know and understand nature directly out of their own experience. Such knowledge and experience are essential if they are to become mature and stable citizens."





This Hopi Messenger Went Astray

By James A. Oliver

IN THE LATTER HALF of August when the hot summer sun bakes the already seared plateaus of northern Arizona, the Hopi Indians perform their yearly rain-making rites that culminate in the famed Snake dance. This final ritual of the nine-day ceremony has created worldwide interest and annually attracts a large number of spectators. At the end of the ceremony the snakes used in the dance are carried by the Snake priests down from the mesa to one of the four shrines located at each of the cardinal points from the village in which the dance is held. Here the snakes are liberated to carry to the gods the petitions of the Indians that rain may be sent to the parched land. The snakes themselves are not held as powerful deities, but are considered only as worthy messengers to the gods.

While the Snake dance is merely the finale of the long ceremony, it is the part that has attracted

the greatest attention. Consequently a great deal has been written about it, both in scientific journals and in sensational magazines. Since the Hopis use large numbers of live rattlesnakes, as well as some harmless species, there has been a lot of speculation as to how they could handle the reptiles so casually — even carrying them in their mouths — without suffering the harmful effects of the venom. Many theories have been advanced and vary from such ridiculous explanations as group hypnotism of the audience or supernatural powers possessed by the priests to such realistic ones as removal of the snake's venom glands or sewing its mouth shut. What are the true facts about the dance and how do the Hopis protect themselves from receiving painful or even fatal bites?

Laurance M. Klauber, our foremost authority on the rattlesnakes, has written a compre-

hensive summary of the herpetological aspects of the Snake dance, based on a scholarly review of earlier literature and a firsthand account of the dance. In outlining the main features of the dance, I shall present what is in essence a brief summary of Dr. Klauber's report.

First it must be realized that the Snake dance itself, while open to the public, is neither a primi-

very few rattlesnakes that were actually used in the Hopi dance have ever been examined by herpetologists. This is the latest.

The Snake Dance of the Hopi Indians is a serious religious ritual concluding rain-making rites held yearly in Reservation villages.

Chicago Natural History Museum Photo

tive type of snake-worship nor an attempt to commercialize a colorful phase of Indian folklore. Rather, the dance is a serious religious ritual that forms part of the ancient heritage of the tribe. The entire ceremony is conducted by two secret societies — not clans — known as the Antelopes and the Snakes. The details of the ritual have been handed down over the years through these societies. In odd-numbered years the dances are held at the villages of Mishongnovi and Walpi, whereas in alternate years they are held at Hotevila, Shipaulovi, and Shimopovi (sometimes spelled Shongopovi), all villages on the Hopi Reservation in northern Arizona. They are usually held during the third week of August and the final rites occur on consecutive days in the different villages.

The first four days of the nine-day Snake cere-



monial are devoted to a ritualistic hunting for snakes. This includes catching all individuals found in the open and digging some out of holes with implements consecrated for the purposes. Both harmless and venomous species are collected. The most numerous species are the Prairie Rattlesnakes (*Crotalus viridis*) and the harmless Bull Snakes (*Pituophis catenifer*), although a few Striped Whip Snakes (*Masticophis taeniatus*) and Glossy Snakes (*Arizona elegans*) are seen occasionally.

The Prairie Rattlesnakes are the most awe-inspiring of this list of species because they possess a venom that is powerful enough to result occasionally in a human fatality. The Prairie Rattlers found in the valley of the Little Colorado River of northeastern Arizona, where the Hopis live, differ sufficiently from other populations of the species to warrant their recognition as a separate subspecies. They are frequently smaller in size and predominantly reddish-brown in coloration as compared with their usually gray-brown or olive-green relatives from areas nearby. When Klauber's studies of these rattlers resulted in their recognition as a different subspecies, it was appropriate that he named them *nuntius*, the messenger.

The snakes are hunted in the area around the villages, one day being spent hunting in the directions of the four cardinal points of the compass — invariably in the order north, west, south and east. If an insufficient number is obtained on the four official days, the priests may continue the hunt informally for several days in whatever directions they choose. When the snakes are captured, they are placed in sacred clay jars and stored in the underground rooms or *kivas* of the Snake priests.

If enough snakes are collected during the four days of formal hunting, the Snake priests remain in their *kivas* the following days and make prayer sticks (*pahos*), prepare their costumes, and observe various sacred rituals, including ceremonial smokes. The Antelope priests take no part in the hunting of the snakes, but remain in or near their *kivas*, carrying out elaborate preparations for the ceremonies. These include the making of an altar with a beautiful mosaic of colored sand, symbolizing the elements of a rain storm; the making of prayer sticks and other sacred objects;

the dramatizing of the ancient myth of the Snake Youth and Corn Maiden from which the ritual stems; and the performing of numerous acts symbolic of rain. Throughout the entire ceremony sacred corn-meal is sprinkled liberally about to sanctify the objects and performers. Appropriate insignia and symbols are placed to keep non-priests from trespassing into the areas where the rituals are being performed.

Klauber mentions in particular the snake-whip or snake-wand, "a wooden shaft about eight inches long to which is attached a pair of eagle feathers." These sticks are used throughout the ceremony to direct, maneuver or quiet the snakes. Only eagle feathers are used, because eagles are believed to be the masters of snakes.

Early in the morning of the eighth day the Antelope race is held. This is the first part of the ceremony that is open to the public — either Indian or white. Most of the young men of the villages compete in this. On the evening of this day the Antelope or Corn dance is held. This is said to resemble closely the Snake dance of the succeeding day. In fact, some writers have interpreted this event as a rehearsal for the Snake dance. The roles of the Antelope and Snake priests are different in the Corn dance from those in the Snake dance, and corn stalks twisted together with melon vines are used in place of the snakes. The ritual is a definite part of the whole ceremony and represents a prayer for the agricultural products on which the Hopis depend, chiefly corn.

On the morning of the ninth day the young men of the villages participate in the Snake race, a cross-country run of four or five miles, terminating in the steep ascent to the top of the mesa on which the Snake dance will be held. At noon occurs an elaborate and secret rite which has been recorded by only a few observers who have gained the confidence of the Snake priests. This is the sacred washing of the snakes to be used in the dance. The chief Snake priest removes the snakes from the sacred storage jars and before the assembled members of the Snake society dips them, in handful lots, in an effusion in an earthen bowl. The snakes are allowed to crawl around on the floor of the *kiva* until dry, or sometimes for as long as two hours. They are then placed in cloth bags to await the dance.



This is the beginning of the dance. The Antelope Priests in ceremonial dress are entering the plaza of the village, carrying rattles of buckskin and bags containing sacred meal.

Photo Courtesy of Arthur Woodward

The long-awaited Snake dance occurs at sundown on this ninth day of the ceremony. Shortly before the dance starts, the snakes in their bags are placed in a small tepee-shaped bower of cottonwood branches called the *kisi* and situated near the center of the plaza where the dance is held. The dance begins with Antelope priests coming from their *kiva* dressed in elaborate ceremonial costumes. They may number from six to twenty, depending on the size of the village. They march out in single file, carrying a rattle of buckskin in one or both hands and a bag of sacred corn-meal. They make four trips around the plaza, always proceeding north, west, south and east, scattering corn-meal on objects of importance to the ritual. On completion of the fourth circuit of the plaza they stand in a single row near the *kisi*.

The Snake priests then enter the plaza from their *kiva*. They also move in single file with the line preceded by one or two chief Snake priests, and like the Antelopes they make four circuits of the area. At the same time one or two priests

enter the *kisi* and remain by the bagged snakes. The Snake priests stop after their fourth circuit, taking a position in front of and facing the Antelope priests. Then follows a slow, weaving dance that goes on for some time, after which the Snake priests gather into trios. As the trios pass the *kisi* one man in the group reaches down and is handed a snake by one of the priests inside the *kisi*. He puts the snake in his mouth, holding it with his lips and teeth about six to twelve inches back of the head. Another member of the trio puts his left arm on or around the shoulder of the priest carrying the snake and the two dance slowly around the plaza. The third man follows the other two men of his group. After going about one and a half times around the plaza the priest with the snake drops or puts it down and gets another as he passes the *kisi*. As he puts down the snake, the priest following him picks it up and carries it until he has accumulated several snakes, at which time he hands some to the Antelope priests. In the meantime other trios of Snake priests are dancing around the plaza, getting snakes from the *kisi*, dancing around with them and then handing them to the Antelope priests. The latter remain standing by the *kisi*, chanting and shaking their rattles to furnish the rhythm for the dancing Snake priests.

Throughout the handling of the snakes in the dance, the snake-wands are used constantly to keep the reptiles distracted or from getting in a threatening position. When all of the snakes have been handed out of the *kisi* and are now held either by the dancing Snake priests or the Antelope priests, a circle is drawn on the ground with corn-meal and all the snakes are dumped into the circle. The seething mass that results creates great excitement, particularly among the adjacent spectators. The Snake priests now rush to the circle, grab up the writhing snakes by the hands-full and run down from the mesa in the four cardinal directions. They run out on the plain below, to the shrines located at some distance from the base of the mesa. Here the snake messengers are deposited, along with prayer sticks (*pahos*) and liberal sprinklings of sacred corn-meal. The priests return slowly to the mesa where they take a purifying emetic, and close the dance with a feast and merrymaking that lasts for four days. The spectators leave the ceremonies as the priests rush off the mesa carrying the snakes to the shrines for liberation.

Now the Snake Priests are entering the plaza in single file, passing the cottonwood bower called the "kisi," where the snakes have been deposited in bags before the dance begins.

Photo Courtesy of Arthur Woodward

From this brief résumé taken from Klauber's detailed summary, it is indicated clearly that snakes are handled freely and incautiously on several occasions. We know from numerous reports that many of the snakes used are venomous rattlesnakes. How *do* the Hopi avoid the unpleasant consequences of frequent bites by the venomous snakes? In his review of the literature, from the first report in 1881 by Charles A. Taylor to the date of his own report in 1932, Klauber classified the many suggested answers to this question as follows:

- A. Conditions affecting the audience
- B. Conditions affecting the priests
 - a. Natural
 - b. Acquired
- C. Conditions affecting the snakes
 - a. Natural
 - b. Acquired

Any proposed solutions involving "A" can be dismissed immediately because numerous qualified scientists have been present in the audience and there is no doubt that live rattlesnakes are handled by the Hopis. Anthropologists have thoroughly investigated all possible suggestions that would come under section "B." There is no strong evidence to support any view that the priests possess a charm over the snakes or an immunity (either temporary or permanent) to the





The dance is in progress. Antelope Priests are at the left and the Snake Priest is holding a small Rattlesnake in his mouth and hands. The Priest behind carries a feather "snake whip."

Photo Courtesy of Arthur Woodward

venom. That leaves us in doubt only about conditions that affect the snakes.

Klauber points out that any snake that is handled much or is disturbed frequently by human activity usually becomes docile. This is well-known to all reptile keepers in zoological parks and is relied upon by reptile showmen. Many observers have remarked on the lethargic and peaceful appearance of the snakes used in the dances. It has been suggested that the snakes were drugged in some way, but there appears to be no evidence for this. Even relying on the docility of individuals that have been handled frequently, there is still considerable opportunity for painful accidents to happen. Some writers have suggested that the Indians broke off the snakes' fangs or caused them to expend their venom by making them strike repeatedly at some object. What was badly needed for examination and study by a herpetologist were specimens actually used by the Indians in the dance. Several

non-herpetologists have reported examining specimens collected for the dance and even those used in the dance. Their reports are conflicting and unconvincing.

The difficulty of getting snakes used in the dance is due to the fact that such specimens have been sanctified and represent sacred objects of a religious ritual. Tampering with them in any way is deeply disturbing to the Indians, just as it would be for us if conditions were reversed. Nevertheless a few specimens have reached the hands of scientists to reveal the true answer to the question.

In 1883 H. C. Yarrow, a competent herpetologist, gained entrance to the snake *kiva* prior to the dance. He selected a large rattler at random and found that its fangs were intact. After the dance he took two rattlers and sent them to the U. S. National Museum, where they were examined by S. Weir Mitchell, a leading authority on venomous snakes. Mitchell reported that the fangs were present and the venom glands were full. Up until the time of Klauber's report these were the only rattlesnakes used by the Hopis that had been studied by a herpetologist. From all of the evidence available to him, Klauber concluded

that the only plausible explanation of the Hopis' apparent immunity beyond the known docility of captive snakes was the evacuation of the venom glands before the ceremony. While it is impossible to expel all of the venom by squeezing of the glands, enough can be removed to render the snakes relatively harmless for a short time. Klauber went on to say that the "final word on this will not be spoken until some herpetologist has had an opportunity to examine carefully several of the rattlesnakes used in the rite, sometime between the ceremonial washing in the *kiva* at noon on the day of the dance, and the ultimate dispersal of these messengers to the gods at the foot of the cliffs after the ceremony."

Klauber's statement was published in January of 1932 and no sooner was it made than Charles M. Bogert, the eminent herpetologist of the American Museum of Natural History, collected a rattlesnake actually used in the Hopi Snake dance at Shimopovi the following August. This was the first rattlesnake messenger to be collected since Yarrow got his two specimens in 1883. Bogert published a scientific report detailing his observations on the dance and the snake he obtained. Later he published an exciting popular account of this experience in *Natural History* for May, 1941. In the latter narration he tells of his carefully laid plans, his studied efforts to appear inconspicuous as he watched with a small telescope while the priests liberated the snakes, and as he approached the shrine, the uncomfortable scrutiny of a nearby Hopi as he first approached it, further delay while this Hopi moved out of sight, the final approach to the shrine, the quick search for the snakes, the finding of a harmless Bull Snake before a rattler was located, the picking up of the venomous snake and rolling it up in a small bag so that it could be placed in his hat to avoid suspicion, and finally his hurried examination of the snake in the shelter of a deep gully — just in case something might happen later.

When Bogert picked up the rattlesnake messenger, he fully expected that it was a snake with its fangs intact, but with some of its venom extracted. Writing of this experience, he said, "it was something of a surprise, upon prying the snake's mouth open with a pencil, to find the *fangs entirely lacking* and obviously removed. With the object of learning something regarding

the condition of the venom glands, pressure was applied with the thumb and finger to the proper region, but no venom, at least none recognizable as such, was forced out into the mouth." The snake was sent to Klauber for his examination and Bogert quotes from the letter he received in reply:

"I pickled the snake last night and found as you had supposed that apparently not only the functional fangs had been removed, but all of the rudimentary fangs as well. In fact, it would appear that the sockets in the maxillary which normally hold the functional fangs, were completely extirpated. This has been done with a knife as indicated by cuts rather than tears, and on the whole it was rather well done, if you forget the snake's feeling in the matter. However, an infection had set in which had already reached one of the pits on the outside. I presume that a snake under such circumstances would inevitably die, particularly as it could get no food, even though it might survive the infection. Offhand, it doesn't seem to me that the underworld gods would be disposed to send too much rainfall in return for so damaged a Western Union messenger. I did not make a dissection to determine whether the venom glands were also removed, but this, after all is immaterial with the fangs so completely gone."

In his scientific report on his findings Bogert reviews the implications of his observation in the light of previous reports. He concludes that "While evidence in this one case is conclusive, there are the following possibilities: (1) Such complete defanging is a recent change in the ritual. (2) Such defanging is practiced at Shongopovi only. (Presentations of the snake dance as given at each of the five Hopi villages are known to be different in minor particulars). (3) Only the rattlers used by the neophytes are defanged. (4) If such skillful defanging is practiced at one village, some other protective measure, such as plugging the hollow fangs, or milking the snakes of their venom as suggested by Klauber, while only a dubious possibility, may be used in other villages. Examination of one additional rattler used in a snake dance held at a village other than Shongopovi would furnish a basis for answering most of the questions raised by these possibilities."

Bogert attempted to obtain additional specimens on the day following his success at Shimopovi. He attended the Snake dance at Hotevila, but remarks laconically, "my attempt to 'collect' another was frustrated." In the two decades that have elapsed since his specimen, none other has been reported, making the specimen Bogert collected the only rattlesnake used in a Hopi dance that has been studied by a herpetologist during

the Twentieth Century. In 1943 the anthropologist, Mischa Titiev, published additional evidence to the effect that the Hopi do break or remove the fangs of the snakes. He obtained this information from the testimony of two former members of the Snake society.

In the preceding issue of *Animal Kingdom* I noted some of the calls for help that are received in the Reptile Department and mentioned one from a college student from New Mexico who wanted us to care for his pet Prairie Rattlesnakes which the Dean of the college did not welcome enthusiastically. Imagine our considerable surprise and great joy when the student delivered his snakes to the zoo — one of them was a Hopi messenger! The modest student, Ole Peloso, of Albuquerque, New Mexico, was unaware of the

scientific importance of his pet. He casually reported the snake's history as though it was little more than his other pet which had no such romantic background.

In 1951 Ole and a companion attended the Hopi Snake dance at one of the villages (he no longer remembers the name) on August 23rd. As the priests liberated the snakes at the shrines, the boys watched and on their way from the dance detoured past one of the shrines. Fortunately, Ole spotted a rattlesnake in a vertical rock crevice. He had observed the Hopi carefully as they handled the snakes and believed that the snakes had been "fixed" in some way. Therefore, he picked up the snake in his bare hands, stuffed it into a bag and beat a hasty retreat from the area. Upon reaching home, the



For comparison purposes, this is the interior of a Rattlesnake's mouth with a probe lifting one of the fangs, still in its sheath. A bare fang may be seen at the right of the picture.



And this is the mouth of the "Hopi Messenger" when it was presented to our collection. The fangs, both functional and reserve, have been completely removed and the snake is harmless.



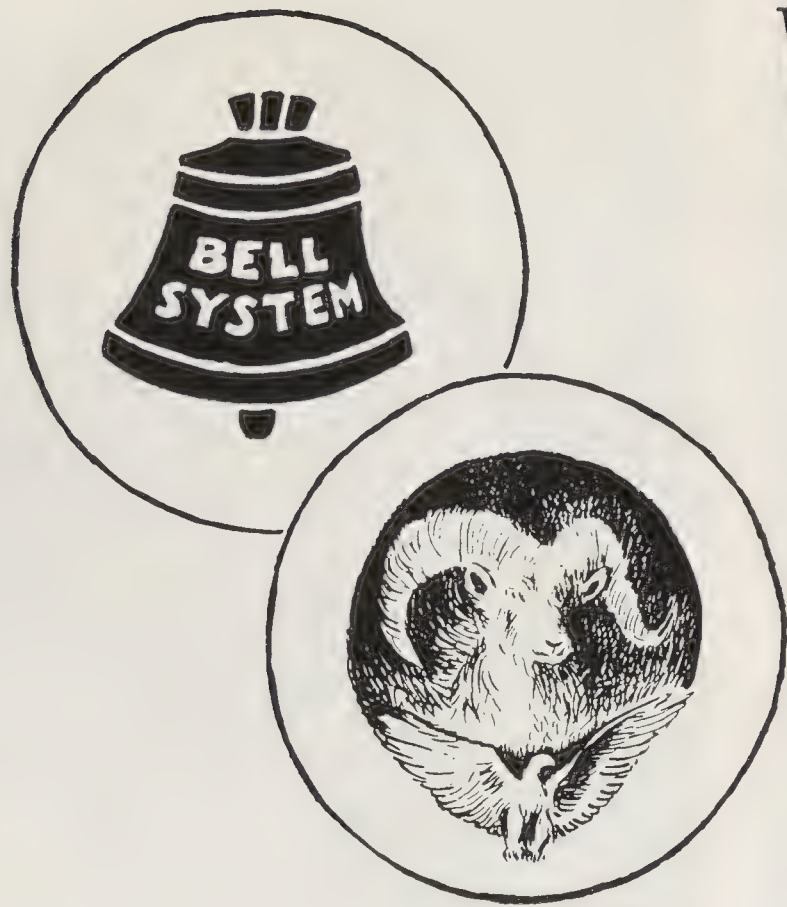
To show just how harmless the Rattlesnake is, Dr. Oliver holds it in his hands. Despite its fangless condition, the snake was able to feed regularly and even put on a little weight.

rattlesnake was examined and found to have no fangs and has acquired none since it was captured. Ole force-fed it on a liquid diet and thus kept it alive up to the present time.

Examination of the snake by gross methods and with X-ray photographs reveals that, as in Bogert's specimen, the functional and reserve fangs, as well as the tooth-producing tissue, have been removed skillfully and effectively. The X-ray photograph made by us indicates that the maxillary bones are still intact and have not been removed. The capture of this second specimen with fangs removed lends strong support to Bogert's suggestion that this is a comparatively recent method of rendering the rattlers harmless and that it is used by Hopis other than those at the village of Shimopovi. While Ole does not remember the name of the village from which his snake was collected, it must have been either at Mishongnovi or Walpi, since these are the two villages holding ceremonies in the odd-numbered years.

Thus the Hopis, like shrewd snake handlers in other parts of the world, have learned to perform an operation requiring considerable skill when done on a live snake. That this knowledge is not limited to the Hopis alone is shown by the fact that venomous snakes used by some of the African snake cults and those used by Asiatic snake charmers are made safe by the same operation. One of the Indian Cobras that has been in our Reptile collection for eight years was purchased from a Hindu fakir. It had its fangs completely removed before it came to us and it has never acquired fangs since. The snake is in excellent health otherwise and feeds readily on dead food. A rattlesnake, particularly, is helpless in the wild when handicapped by the removal of its fangs.

I am happy to report that Ole's rattler has been taken off its liquid diet and is now feeding voluntarily on dead mice from our freezer. What wonderfully strange turns of events are possible in this modern age of ours! A helpless defanged rattlesnake, dispatched by the Hopis to carry their pleas for rain to their gods, goes awry with the help of a young college student and arrives in New York City where it is kept alive on quick-frozen mice!



Why Is the Zoological Society Like A. T. & T.?

When you give a share of telephone stock to your little boy you are investing in his future, aren't you?

STRANGE AS IT MAY SEEM TO YOU, there is a similarity between the New York Zoological Society and the world's foremost system of communication.

Our Society, first of all, is also in the communications business. It is the purpose of our institution to establish contacts between people and animals — animals from all over the world — animals even from many places where there are no telephones. It is our business to study animal forms, to discover new knowledge about them. And, like A. T. & T., we have our laboratories where technicians bring their findings for study and relation to the steadily mounting store of biological fact.

Again, we must extend the results of our experience to more and more people. We must interpret the animal world. Just as the telephone seeks to bind the community more closely together with wires and instruments, our Zoological Society attempts to increase the bond between people and the living things in the world around them. This we do in many ways including information services, publications, radio and television.

It requires particularly trained people to collect the strange, rare and beautiful creatures of the earth. We must have capable technicians to study and interpret them. We need a special kind of man and woman to care for animals and to rear their young. This necessity for skill and training is as great with us as it is in the highly specialized functions of A. T. & T. personnel.

And, because of this skilled achievement of many patient people, the Zoological Society, like A. T. & T., has a conspicuous record of "earn-

ings." The difference, of course, lies in the fact that the telephone industry measures its success in dollars while we compute our values in popular interest — the constantly growing numbers of people who depend upon the Society, the Zoo and the Aquarium, representing the largest regular attendance of all the recreational and cultural institutions in the great city of New York.

Nobody Owns the Telephone Company

Everybody uses telephones but the ownership of the company is not in the hands of a few people. Many thousands of friends, its stockholders, own A. T. & T. They invest in the industry to enable it to continue and expand its services, to rebuild obsolete installations, to improve methods of bringing people together. A. T. & T. could not exist without these adherents, whose devotion is of course maintained by dividend checks.

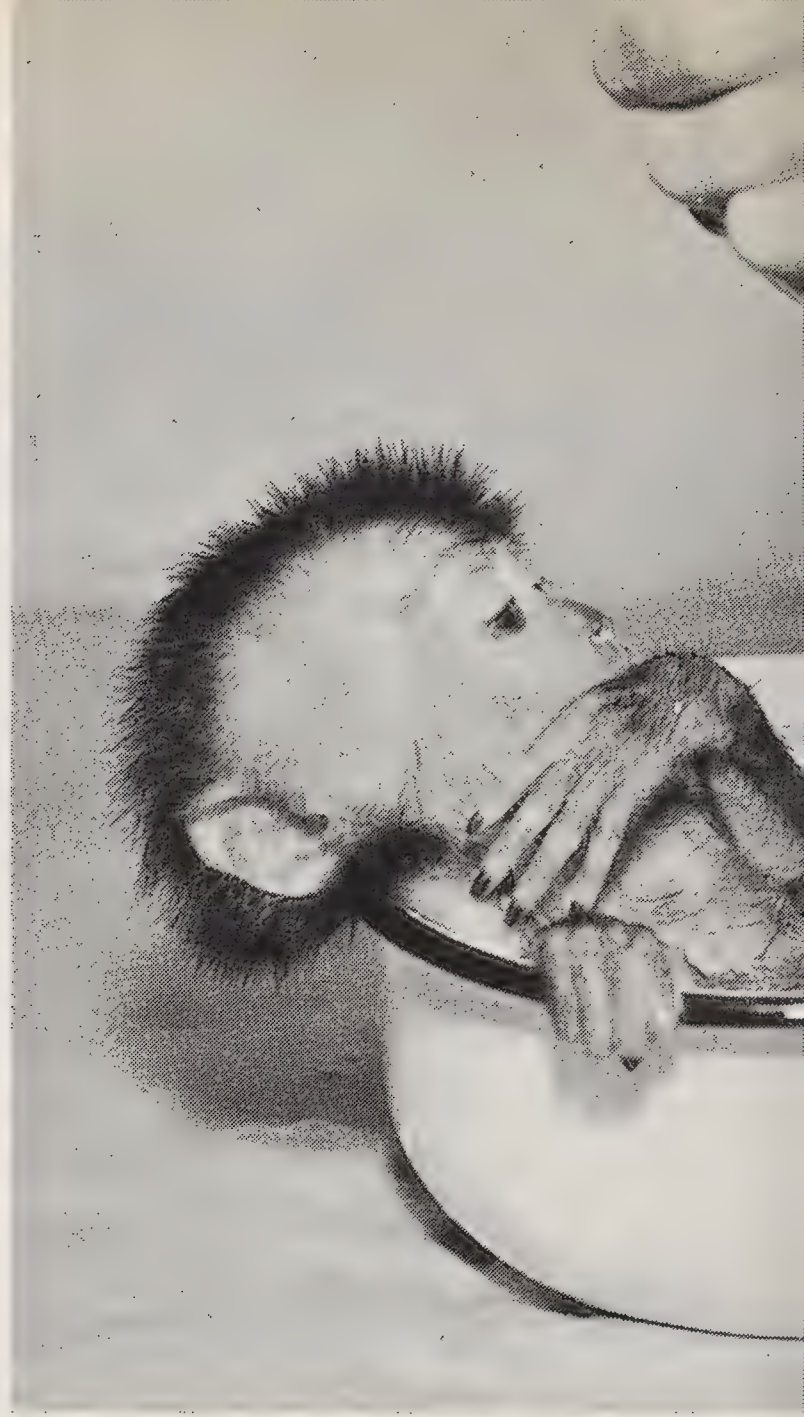
No particular group owns the Zoological Society either — or the Zoo — or the Aquarium. These belong to everybody, and, like the telephone, everybody uses them. And again the Zoological Society could not exist and grow without its friends, its members. As a member, you invest in our country's greatest center of living natural history. Your dividends do not come in the form of checks. They come in satisfaction — with a bonus of pleasure from your membership privileges.

When you make a gift of a Society membership, when you send in your own dues, you are making an investment in satisfaction, in the rewards of a truly unique human enterprise — in which the animals are our partners.

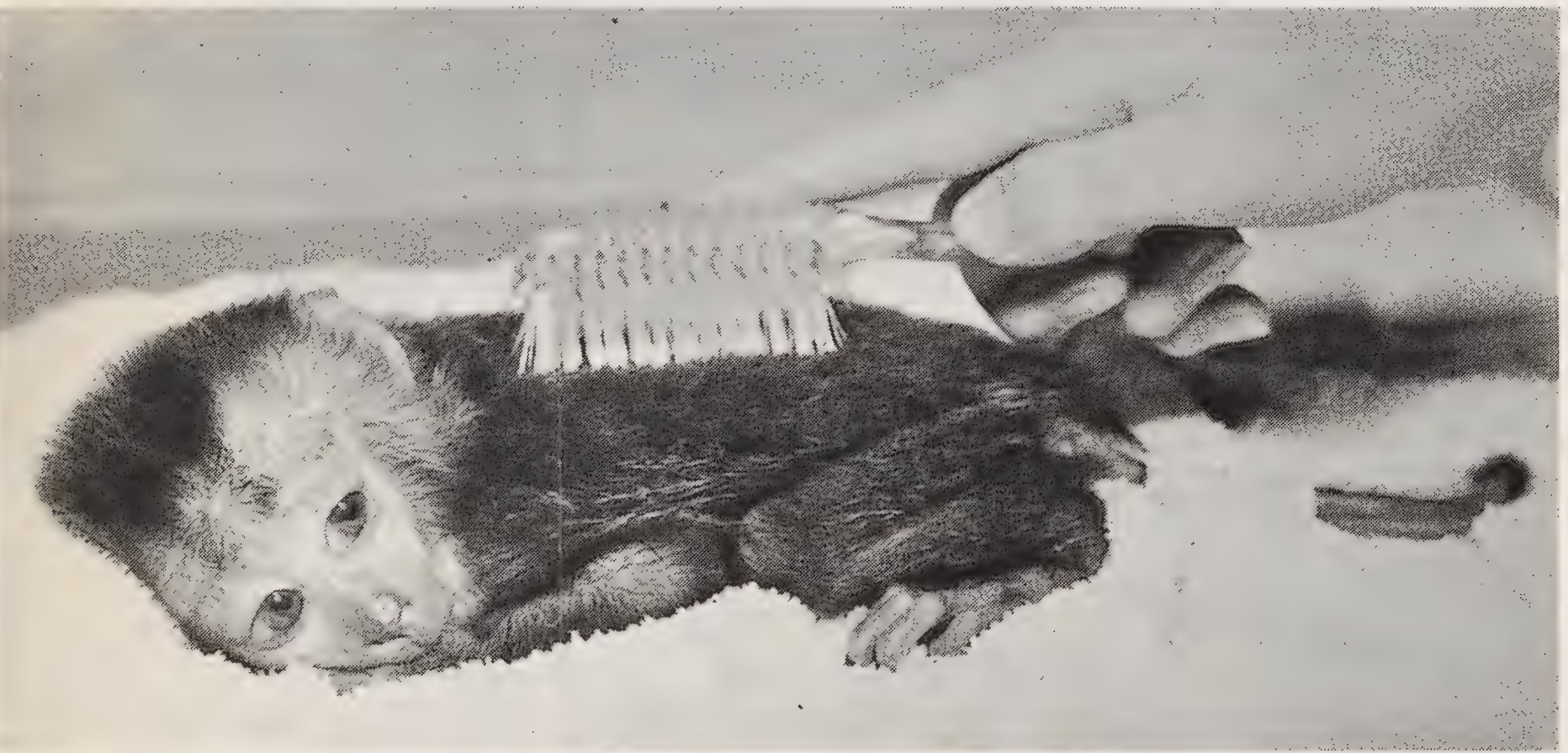
The Zoological Society is a "blue chip" investment. It is a vital example of the American way of doing things, as democratic as Democracy itself.



Kenneth is perfectly able to feed himself, but he prefers this way.



Sometimes he doesn't parti

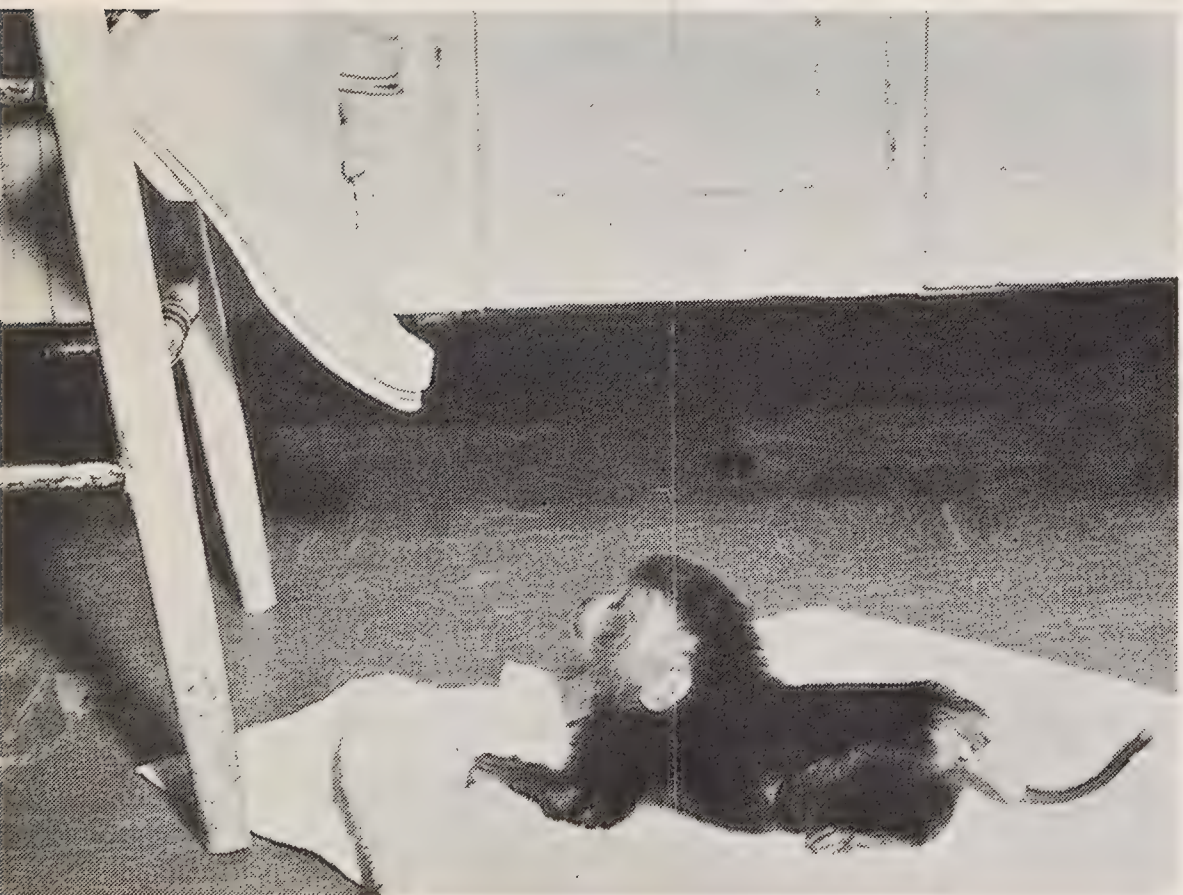


The only redeeming feature is that a bath is followed by brushing.

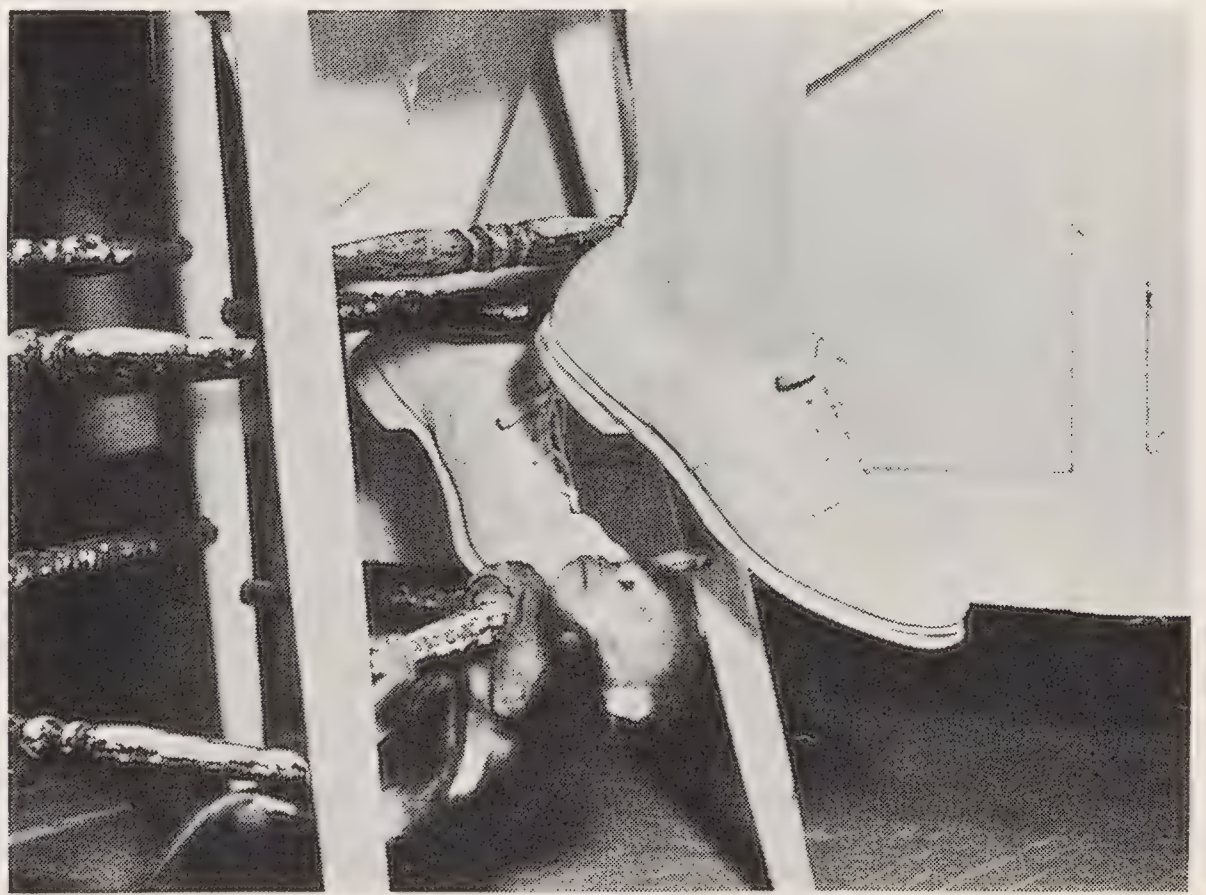
A DAY WITH

The little Wanderoo named Kenneth was cared for by Nurse Mary Murphy in the July-August "Animal Hospital" column. He was a favorite with the staff the whole time he was home in the Hospital. He was a little bit of a trouble maker, but he is old enough now that Nurse no longer takes his

Photograph



When Nurse Murphy sat on a laboratory stool, Kenneth invariably wanted to climb up to her.



His climbing ability was more a matter of determination than of actual accomplishment.



It was
work



the ritual of a warm bath.



At other times this cleanliness arouses much less enthusiasm.

KENNETH

h," whose adoption by
hospital was pictured in
, " has become such a
s to have a permanent
s care and daily atten-
y by himself and the
subway every evening.

DUNTON



*ed the same way—the Nurse
own, extend a helping hand.*



*And for complete bliss, all that was necessary was for the Nurse
to stuff him into the pocket of her uniform and carry him all day.*

What We Are Learning About ELECTRIC FISHES

By CHRISTOPHER W. COATES

IN THE PAST FEW YEARS the New York Aquarium has had the good fortune to share in research that is opening up an exciting new field — the quest for a hitherto unknown type of sensory receptor in fishes. When the discovery is made it will be as novel and stimulating to enquiry as the recently demonstrated ability of bees, ants and horseshoe crabs to detect polarized light.

Specifically, the team of which the Aquarium is a part has detected, studied and described the electric discharges of two knifefishes from tropical South America, the Glass Knifefish, *Eigenman-*

These discoveries are mere spadework, piling up data and refining techniques that will be useful when an attack is made on the real problem: *why* these and other fishes possess the power to give off tiny electric discharges, what purpose they serve.

* * *

Probably all animals, as well as many plants, produce electric discharges. Human beings certainly do, and the measurement of minute currents from the brain, heart, muscles and nerves is routine in certain clinical and hospital procedures. We all “run by electricity,” but of



nia virescens, and its relative-without-a-common-name, *Gymnorhamphichthys hypostomus*. We have described in detail the discharge of a third Knifefish, the Carapo, *Gymnotus carapo*, whose electric properties had previously been reported in only the most summary form. As a result we have good reason to believe that the entire Family Gymnotidae is “electrogenic” — fifty or more fishes yet to be measured in the laboratory.

The research team of which the Aquarium is a part has described the weak discharge of this Knifefish, *Gymnorhamphichthys hypostomus*.

course the amounts of current involved are so small they can usually be measured only by sensitive electronic instruments — probably they never exceed a tenth of a volt. Furthermore, since land animals are surrounded by air, which is a

relatively good insulator, these very small discharges cannot be detected at a distance from the body.

With animals that live in water it is different. Water is a far better conductor than air, and some aquatic animals have developed a special mechanism that allows them to discharge impulses at relatively high voltage. The Electric Eel from the streams and swamps of northern South America is the best-known of these living electric machines. Our own popular exhibit of the creature, with demonstrations every hour of its ability to make a loudspeaker squawk with static and electric lamps to light up, has done much to make it so widely known. The eel produces an enormous amount of electricity — up to 650 volts — and when this current is discharged into the water the electric field it sets up is large enough to hurt or stun the fish's enemies or prey.

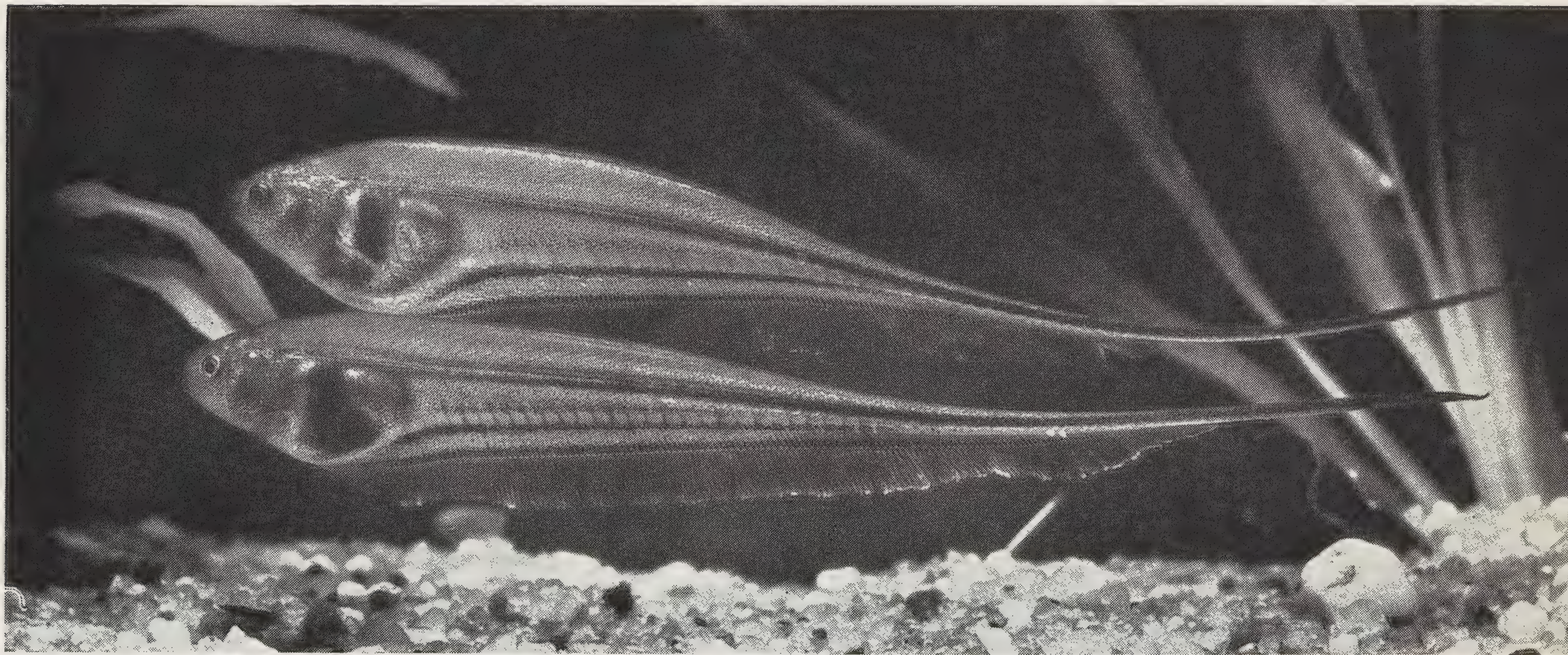
Less well known to the public, but equally well established as electricity-producers, are various other fishes. The Torpedoes, a group of

to grow to a length of about four feet, however, and presumably the larger specimens would be more powerful.

Much less potent are the two or three Electric Stargazers of the western Atlantic and the eastern Pacific. To the best of our knowledge no one has measured the current produced by their small electric organs (located behind each eye), but we do know that it is strong enough to be felt by the human hand.

These, then, were for many years the only fishes definitely *proved* to be electric in the sense of giving off appreciable discharges from specific, electricity-producing organs. To be sure, anatomists have found what looked like electric organs in several other kinds of fishes and from their descriptions it was hard to believe that they could have any function except to produce electricity. But no one had ever felt or measured their electric current, with one rather dubious exception.

All these fishes suspected but not known to be electric were in two groups, the Skates and the



thirty or more marine electric Rays, include species with the next most powerful discharge. Large Torpedoes can give off more than 200 volts. Then there is the Electric Catfish of the lakes and streams of Africa. Reports on its strength vary greatly, but it cannot match the Electric Eel nor, probably, a large Torpedo. We have measured specimens four to eight inches long and obtained readings of only about 80 volts. The fish is known

The Glass Knifefish is another South American fish now found to give off electricity. It discharges at a rate of 300 impulses each second.

Mormyrids. The Skates are distant relatives of the Torpedoes. Both are shark-like fishes that have become greatly flattened, but there the resemblance stops. In the Torpedoes the pair of large, flat, oval electric organs occupies a good

part of the fish's roughly pancake-shaped body, while in the Skates the corresponding structures are merely two strips of tissue running down the long, thin tail. Although some of the commonest Skates possess these unusual organs, there is only one report of anyone trying to determine their electric output.¹ The estimated measurement was half a volt, not nearly strong enough to be felt by the bare wet hand.

The Mormyrids are a family of fishes confined to the fresh waters of tropical Africa, and few people outside of that continent even know of their existence. Some of them are important food fish, however, and ichthyologists have long been interested in them because of their bizarre appearance and extraordinarily large brains. At least some of the strange Snoutfish, belonging to the genus *Mormyrus*, have small elongate organs, presumed on anatomical grounds to be electrogenic, located in the posterior part of the body and the tail. A close relative of the Mormyrids, the Jerfar, *Gymnarchus niloticus*, is similarly equipped.

Not until the development of extremely sensitive devices for the detection and measurement of electricity and the subsequent adaptation of them for use in the biological laboratory, was there any way to find out whether the so-called weak electric fishes really could discharge electricity into the water around them, and if so, how and why they did it. With electronic instruments, such as amplifiers and cathode ray oscillographs, technicians can record the most minute electric currents at practically the speed of light. Using such instruments, Dr. H. W. Lissmann of Cambridge University has recently found that *Gymnarchus* does indeed regularly emit small electric currents, while Dr. W. Holmes of Oxford has made similar observations on *Mormyrus kannume*.^{2, 3}

For many years we have been studying the physiology of the Electric Eel, working primarily with a group of scientific specialists headed by Dr. David Nachmansohn and located at the College of Physicians and Surgeons of Columbia University. Here the latest techniques in biochemistry and biophysics are being used to reveal just how the Electric Eel generates its power.⁴ Not long ago we turned our attention to some of its smaller relatives, the Knifefishes, with the result mentioned earlier in this article.

The reason why the electrical abilities of the Knifefishes have gone unsuspected so long is that they produce quite feeble current. Dr. Lissmann was the first to report electrogenic properties in a Knifefish, the Carapo, but he gave no details of his investigations. We have been able to study and describe the discharges of this species in detail, as well as those of two other Knifefishes, *Eigenmannia virescens* and *Gymnorhamphichthys hypostomus*.⁵ We have also made preliminary observations on other Knifefishes, and to date every species we have examined has proved electrogenic.

In order to pursue these studies, three of us joined forces, making a team in which each member could bring his specialty to bear on the problem: Dr. Mario Altamirano, neuro-anatomist and physiologist, Dr. Harry Grundfest, biophysicist; and myself, ichthyologist. We found that the electric impulses of the Knifefishes never exceed three-tenths of a volt. They are emitted with remarkable regularity and great rapidity, some 300 discharges each second by *Eigenmannia*, 100 per second by *Gymnorhamphichthys*, and 65 by *Gymnotus*. It makes no difference whether the fishes are swimming about or resting on the bottom of the tank; the discharges go on as usual. In this respect these impulses are quite different from the ones put out by the Electric Eel, and this brings us to the fundamental and perplexing question of what use these tiny electric discharges are to the fish.

Electric Eels and Torpedoes use their powerful discharges both to defend themselves and to secure food by shocking other fishes, frogs and the like into insensibility. There seems little doubt that the Electric Catfish and the Stargazers employ their electricity defensively, but whether they also catch their prey with its help is not known. No observations to date give any inkling that they do. The Electric Eel, however, employs its electricity in still a third way, and it is one which gives a clue as to how the weak electric fishes — that is, the Mormyrids, the Knifefishes and probably the Skates — use theirs.

The first intimation that some of the electrical activity of the Electric Eel was not connected either with offense or defense came from listening to them as they swam about in one of the tanks at the old Aquarium at the Battery. A pair of

ordinary headphones, of the kind used by wireless operators, provided an easy way to determine whether the Eels were discharging, since the electrical disturbance is picked up and can be heard as clicks or "static." It was noticed that although all was quiet so long as the Eels lay on the bottom, a series of "ticks" could be heard in the headphones as soon as they moved about. These "ticks" were entirely different from the crashing barrage of noise that resulted when the Eels were discharging because they were annoyed or were being fed. Subsequently these smaller discharges were measured and found to range up to about 50 volts with a frequency of about 50 discharges per second. At first it was thought that they might serve as a warning, put out by the Eels to keep potential enemies away. Gradually another possible explanation dawned on us.⁶

All Electric Eels more than a foot or so long are blind. Although smaller ones are apparently equipped with perfectly normal eyes, something begins to happen to them in this stage of their development and the eyes soon turn opaque and useless. Nevertheless, Eels are able to find their prey with surprising accuracy and can differentiate between a fish and, say, a small block of wood without ever touching the object or even coming near it. We know that Eels are sensitive to each other's electricity because they will immediately gather around the head of a discharging individual, energetically searching for food. Could it be that an Eel reacts to *its own* electricity? This train of thought led to a series of

The Carapo had previously been reported as an electric fish, but no details were given. Now its discharge has been studied and described.

experiments, made during the war, from which it appeared that the Electric Eel does indeed use its own electricity to locate objects and obstacles in its environment. Careful measurement showed that the impulses came from the posterior region of the Eel's body, not from the greater length of it as do the stronger discharges used for protection and to get food. Painting the head of an Eel with an insulating lacquer showed that the receptors for the information returned by these impulses are undoubtedly located there. How these head receptors operate is still a mystery, however.

More recent experiments along these lines have been performed by Drs. Richard D. Keynes and Hiss Martins-Ferreira at the University of Brazil in Rio de Janeiro, and, as far as they go, they confirm those of our own.⁷

The Electric Eel is undoubtedly not the only fish that employs its electricity as a sort of electrical locating device. *Gymnarchus* from Africa also appears to do so. This species, however, like the Knifefishes, gives off a continuous stream of electrical impulses from the region of its tail — roughly 300 of them per second with a maximum of about 3/100ths of a volt — and is definitely aware of any conductors put into its tank.

One feature that many electric fishes have in common is a long body or tail. In all of these elongated species, the electric discharges that are probably used to explore the environment come primarily from organs located near the posterior end of the body. The Knifefishes have, as their name implies, a very narrow triangular shape. They move about by undulating the anal fin which extends along the belly for almost the whole length of the fish. They can move back-



ward and forward with equal ease, and are just as likely to dart off directly toward the rear, tail first, as to go forward. While traveling backward at considerable speed they can pass through small holes without ever touching the sides. A system of electro-location would nicely explain this amazing faculty. *Gymnarchus*, too, moves backward just as easily as forward by undulating one of its fins, but in this case it is the dorsal fin, which runs the entire length of the fish's back, that is so used. *Gymnarchus* also possesses remarkable ability to avoid running into things while darting toward the rear. The small electric organs of the Electric Skate, which are located out on the long, slender tail, may very well be used as electro-locators in a similar manner, although the Skates we have seen never have swum backward even though they might easily do so.

The idea that the continuous, small, rapid, rhythmic discharges are a type of mechanism useful for orientation or for locating objects in the water is still only a theory, however. This is because we as yet know nothing about any possible receiver-mechanisms by which the fish could detect alterations in its electric field caused by obstructions or possible sources of food. Extremely sensitive, highly specialized electric detectors would be necessary, and just how they would operate is pretty much of a mystery — at least in the present state of our knowledge. The peculiar pits on the head of the Electric Eel are obvious possibilities and need careful investigation. Dr. Holmes has found unusual structures at the ends of the nerves under the dorsal fin of Mormyrids. When the connection of these to the brain was severed, the fish became less responsive to the presence of other fishes and to any electrical conductor placed in its tank. We agree with Dr. Keynes in suspecting that an entirely new type of sensory receptor is most probably awaiting discovery.

Another possible use to which the weak electric discharges of fishes may be put is to provide a means of communication with one another. When, by means of an electric recording device, its own impulses were fed back into the water of its tank, Dr. Lissmann's *Gymnarchus* vigorously attacked the electrode from which they emanated. In our experience, all of the Mormyrids and

many of the Knifefishes are so quarrelsome that only a single specimen of any one species can safely be kept in an aquarium, unless the tank is very large. Perhaps the weak electric impulses of these aggressive fishes act as warning devices, telling another fish to keep its distance, so to speak. Or they may at times serve to attract desired companions or mates.

The discovery that weak electric organs are probably widespread among the Knifefishes helps answer one knotty evolutionary problem. In the evolution of the Electric Eel, how did this fish acquire its tremendous electric powers? Once the Eel had enough electricity to defend itself or to stun prey, natural selection could augment this faculty, since the more powerful Eels would be better able to escape destruction or obtain food. But of what use could electric organs be to the fish during the long evolutionary period when they were just beginning to develop? Many zoologists have puzzled over this; Darwin himself was at a loss to explain it. Now, as Dr. Lissmann has pointed out, the question has been at least partly answered. The Carapo has been considered one of the most primitive, unspecialized members of the Knifefish family and most similar to the ancestral fish from which the Electric Eel evolved. Now we can see that the original utility of the Eel's electric organs may have been as an electro-locating device. The development of more powerful organs for feeding and defense came later.

Our discovery of the production of electrical discharges by the Knifefishes has naturally awakened great interest in the behavior and physiology of these fishes, but it also gives promise of providing another tool for the analysis of the production of electricity by living cells. There are things we can do with the weak electric organs that are impossible with the organs of the more powerful Electric Eel. Thus the Knifefishes may very well take their place next to the Electric Eel as one of the most useful of laboratory animals.

REFERENCES

- ¹ Bigelow & Schroeder, "Fishes of the Western North Atlantic." Part II, 1954.
- ² Lissmann, *Nature*, 167 (4240) : 201-202, 1951.
- ³ Ann. Rpt. East African Fish. Res. Organ. for 1951: 4-5, 1952.
- ⁴ Coates & Nachmansohn, *Animal Kingdom*, 53 (2) : 34-40, 1950.
- ⁵ Coates, Altamirano & Grundfest, *Science*, in press.
- ⁶ Coates, *Atlantic Monthly*, 180 (4) : 75-79, 1947.
- ⁷ Keynes, *Discovery*, 13 (6) : 172-174, 1952. Keynes & Martins-Ferreira, *Journ. Physiol.*, 119 (2/3) : 315-351, 1953.

Good Haters-

AUSTRALIA'S SQUIRREL GLIDERS

By DAVID FLEAY

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A parent Squirrel Glider with babies on its back. The parachute-like membrane which enables the Gliders to volplane can be seen on the left side of one of the youngsters.

All Photos by the Author

HERE AT WEST BURLEIGH some ten miles over the New South Wales border in sunny Queensland's south coast area, the pretty, soft-furred (and sharp-toothed) Squirrel Glider is our commonest tree mammal — almost as omnipresent as the Gray Squirrel of the New York region although far less often seen because it is nocturnal.

"Squirrel" Gliders they are called, but of course they are not squirrels; Australia has no squirrels. They are marsupials, really flying phalangers, scientifically known as *Petaurus norfolcensis*, but Squirrel Glider is the name commonly used because they have a fluffy, squirrel-like tail and they glide very much like the Flying Squirrels of North America.

This very night, only a few minutes before I sat down to write this article, a Squirrel Glider almost glided into my automobile. I had been out shooting big fruit bats, "flying foxes," as food for part of my animal collection, and was just driving home to my garage when a Squirrel Glider sailed out of the darkness, across the path of light in front of the windshield, and landed on a tree trunk alongside the drive.

Indeed, when shooting bats, I have to be most careful to differentiate between the eye-reflection of the bats and the shining eyes of the pink-nosed gliders skipping from branch to branch in the Moreton Bay fig trees. It is easy enough if you take time to notice the movements of the animal.

No mere description of color and markings can give an adequate picture of this vivacious creature. Its fur is soft gray, fine and slightly woolly, dark-streaked on head and back and rump; underneath the fur is glistening white suffused with yellow. A delicate pink nose, pink-soled feet and black patches at the base of the



ears complete the over-all description, but to get the full measure of a Squirrel Glider you have to be bitten by one. They are equipped with narrow and tapering lower incisors half an inch long, and anyone rash enough to plunge a hand into a nesting hollow (as I have been a few times) is sure to be bitten savagely.

At least two other gliders, the Greater (*Schoinohates volans*) and the Fluffy (*Petaurus australis*), are both larger and noisier; indeed, the prolonged gurgling shrieks of these two during their volplaning activities are characteristic night sounds of the eastern Australian bushlands. The Squirrel Glider is only about twenty inches long, of which some eleven inches are made up by the tail, and its volume of sound is not extraordinary. However, it makes up for this by its droning, self-starter cursing — I can think of no

The Dusky Glider is the largest of the gliding possums, and therefore is able to sail further than the smaller ones. Even the little Squirrel Glider can make skimming leaps to 60 yards.

other expression for it — when it is handled against its will or is engaged in one of its frequent family squabbles. Oddly enough, although it is to all intents and purposes simply a larger edition of the little Sugar Glider (*Petaurus breviceps*), and interbreeds with the Sugar Glider under conditions of captivity, its voice and “vocabulary” are somewhat different. The Squirrel Glider drones and whirrs when it is angry and that is its usual note; I have never heard it give forth the repeated terrier-like yaps or shrill grunts so often heard when a Sugar Glider is puzzled or nervous or annoyed.

One other thing must be said about Squirrel Gliders: they are good haters.

Once, slipping silently through the forest at night, I came upon two male Squirrel Gliders fighting in a tall gum tree. So engrossed were they in their feud that they paid no attention to me, not even when their savage attacks carried them off the limb and they fell in a tangle of fur at my very feet. They simply went on fighting until I reached down and grabbed them. Then, of course, they forgot each other and both sank their teeth in my hands.

They are excellent gliders, and skimming leaps of fifty or sixty yards from the top of one tree to the trunk of another are common. The secret, of course, is the gliding membrane, joining the fifth finger, the flanks and the ankles. This skimming locomotion is undoubtedly convenient when it comes to feeding, for the Squirrel Glider is not a leaf-eater and it may have to travel considerable distances to find the nectar and insects that make up the bulk of its food.

The greatest treat that I can give the Squirrel Gliders in my collection is the larvae of longicorn beetles. Toss in a handful of these big creamy larvae and every glider scrambles to be first at the feast. Up they sit, exactly like squirrels, with the grubs held tightly in both forepaws. They are also particularly fond of moths, beetles, crickets, katydids, cicadas and grasshoppers — and in times of stress they will even tackle small birds and mice.

Some years ago during a winter period when insects were not readily available we were astonished to find that the Squirrel Gliders had made a nocturnal attack on a half-grown Guinea fowl which shared a big cage with them. We had been supplying plenty of bread and milk, jam and strips of fatty meat — delicacies that had served very well up to that time — but their appetites had taken a turn for bird, and they attacked the nearest victim, stripping the feathers and part of the flesh from one wing. They take so readily to small birds that I am sure they prey occasion-

ally on sleeping Honey-eaters and other small birds in the treetops, particularly during the colder months when insect food is scarce.

A very great part of their diet is derived from the nectar of blossoms, sap licked from small branches that have been pierced or stripped by the sharp teeth, or sweet exudations from trees and the sugary substances of berries and fruits.

Our own Squirrel Gliders here at West Burleigh have built a large, comfortable, cup-shaped nest of gum leaves in an old box. Each leaf is neatly stacked on edge.

While they were building it I used to spy on them at night, fascinated by their dexterity. The usual procedure was for me to bring in an armload of eucalyptus branches at dusk. After nightfall the gliders would scamper for them, usually hanging upside down on the branches to sever sprays of leaves with their teeth. Once a cluster of leaves was free, it was expertly passed backward along the belly by the forepaws, taken over by one hind foot and pushed upward so that the



Curious about what is going on, a Sugar Glider peeps out of its hole in a tree. This species is smaller than the Squirrel Glider, is more plentiful, and covers the widest range of all.



The Gliders are good parents. When Mr. Fleay picked up a baby that was born to a couple in his collection, the Sugar Glider mother overcame her timidity in concern for the youngster.

tail could take a twist around the bunch. Eventually thoroughly loaded and unable to glide because the tail was in use, the little animals would scurry along the branches and pop into the nesting box to make the characteristic neat arrangement.

Squirrel Gliders live in family groups of five or six or more, a unit that is most intolerant of intruders of its own kind. A "foreign" glider straying into the neighborhood can be sure of a hostile reception.

Owls are the gliders' major natural enemies; the Masked, Sooty, Powerful and Barking Owls occasionally pounce on an unwary glider. Far more serious are the depredations of the common cat, both feral and "attached," and the discovery of the thick, furry tails discarded by cats are all too common evidence of the destruction of gliders in Queensland.

In this warm and equable climate there ap-

pears to be no special season for the appearance of the two young in the maternal pouch. In fact, one female that reared twins four months ago already has another set at the pouch-leaving stage. The gestation period is only about three weeks and the little ones at birth are more active than the embryo Dasyures or "native cats" at the same stage, and almost twice as large.

By the time they are two months old the pink infants show a covering of short fur. Very soon after this, although their eyes are not yet open, they are too large for the pouch and simply cuddle up with the parents in the leafy nest. While the father is out flitting hither and yon in the starlight, the mother acts as baby-sitter; when father returns, mother will make her food-hunting forays. When they are separated from their parents, the babies utter slow, repeated cries that usually bring the female to them in haste—even in the daylight that they hate so much.

At a little more than ten weeks the babies' eyes open and subsequent growth is quite rapid until, at four months, they begin to rely upon their own resources though remaining in and a part of the family group.

News from the Conservation Foundation

Research

Three new research survey projects are in the stage of active planning. The first is a study of water laws in the Eastern states and their adequacy with respect to foreseeable regional water needs for all purposes. The second, to be conducted by Dr. Richard L. Meier of the University of Chicago, will consider long-range implications of human fertility control. The third has to do with an analysis of the degree of insufficiency of our present hydrologic and meteorologic knowledge.

Wildlife Surveys

The Foundation's study of Marine Resources is nearing completion. With joint sponsorship by the New York Zoological Society, President Osborn this summer set up a project in behalf of the American bighorn sheep, their population, distribution and long-range protection requirements. A considerable quantity of field observation records has already come in for review. Also in joint collaboration with the Society we are starting a survey of the prairie-dog and related animal and plant life of the Western plains, an ecological analysis long overdue.

Natural Resources Council

Executive Vice-president Samuel H. Ordway, Jr., on October 12-13, acted again as Chairman at the Natural Resources Council meetings in Washington, an important affiliation since it maintains our active relations with some thirty-five other conservation groups. Along with other advisors to the Secretary of the Interior, Mr. Ordway urged the Secretary to review the matter of long-range plans for hydro-electric power development in view of atomic power and lignite implications.

In Educational Fields

Activity in education or public information has been brisk. In October Vice-president George

E. Brewer, Jr., and other staff members met with Dr. Charles E. Lively of the University of Missouri to discuss the results of the study which Dr. Lively initiated last spring for the purpose of determining the degree and quality of conservation teaching in American institutions of higher learning. The group will consider the answers received through Dr. Lively's initial questionnaire.

Also in October Mr. Brewer traveled to Higgins Lake, Michigan, to attend the meetings of the Mid-west Conservation Education Conference.

At Yale the conservation courses continue for their fifth year. Dr. Paul Sears will take a sabbatical leave and his place will be filled by Dr. Fraser Darling. A further sum of \$5,000 has been anonymously contributed for the support of conservation scholarships at Yale. The seminar at the Littauer School at Harvard, initiated by the Conservation Foundation, also continues into its fifth year with participation by the Harvard Law School and with support of Carnegie Foundation and Ford Foundation grants.

Water

"The importance to the United States of conserving its water resources has been well expounded recently by Mr. Fairfield Osborn in a speech before the American Chemical Society." These are the opening words of an editorial in the *New York Herald Tribune* of October 17. This address was widely and favorably received by the press.

Mr. Snider's Trip

On October 5, Vice-president Robert Snider, our research chief, returned from Europe where he had taken part in the meeting of the International Union for the Protection of Nature in Copenhagen, and subsequently, the International Population Conference held in Rome under the auspices of the United Nations.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

An Interesting Gift from an Unexpected Source

A New York attorney recently telephoned the Reptile Department to say that he had a rare venomous snake from the Matto Grosso of South America and that he would like to donate it to the Zoological Park provided we would "milk" it for him and give him the venom. This was the first time anyone outside the medical profession had asked for fresh venom, and Curator Oliver's interest was aroused. It developed that the venom of this particular snake was allegedly used by South American natives for the cure of cancer and tuberculosis, and that the attorney had so reported to an acquaintance on the staff of Yale University. The Yale people put little faith in the story, but were interested in testing the venom anyway, hence the request to us. The snake was duly delivered to the Zoological Park by Mr. Nicholas J. P. Tryforos, the attorney, and was found to be a healthy-looking specimen of the "Jararaca" or Maximilian's Viper, *Bothrops neuweidi*, which we did not have in the collection at the moment. It comes from southern Brazil, Bolivia and northern Argentina.

Visitors from Abroad

Mr. Axel Reventlow, Director of the Copenhagen Zoo and president of the International Union of Directors of Zoological Gardens, visited the Zoological Park at the beginning of October. Subsequently, after a tour of other zoological parks in the United States, Mr. Walter Van den bergh, Director of the Antwerp Zoo, spent several days with us.

Cecil Up, Penelope Down

Cold weather has caused the closing of the Platypusary for the winter, Cecil, the male, being removed to winter quarters on October 27 and Penelope, the female, three weeks earlier. Cecil weighed 3.366 pounds on April 27, and 3.608 pounds on October 27, a gain of .242 of a

pound. Penelope, on the other hand, lost .11 of a pound between April 27 and October 30, dropping from 1.782 pounds to 1.672. Both animals are apparently in good health and are feeding well. They arrived from Australia on April 26, 1947. — W.BR.

New Giraffes on Exhibition

What we hope will eventually be a breeding pair of Masai Giraffes has been received from Tanganyika and was placed on exhibition in the Antelope House in early November. The handsome, "leaf-marked" youngsters were captured a hundred miles south of Arusha. The male, about 20 months old, stands 8½ feet high, and the female, perhaps two years old, is 9½ feet tall. We also have a Uganda Giraffe, "Jill," which came to us in 1946.

Tilapia Reprints Distributed

Because it seems to be the most complete summary as yet published of the use of Tilapia as a food fish throughout the world, James W. Atz's "The Peregrinating Tilapia" has been reprinted from the September-October issue of *ANIMAL KINGDOM*, and 2,000 copies were distributed at the United Nations Day celebration at Baltimore in late October. The Food and Agriculture Organization exhibited Tilapia at the meeting.

An Elderly Wood Turtle

The Reptile Department has received from Mr. John Gugenhan of Brooklyn a Wood Turtle that was collected at Middletown, N. Y., in 1900. It is reported to have been the same size then that it is now, and thus was presumably full-grown more than half a century ago, indicating an age of at least sixty years. The reptile had been kept as a pet by the owner ever since it was collected and was allowed to hibernate in the basement during the cold months. It shows its age, and appears to be an authentic patriarch. — W.BR.



“Oka,” our large female Lowland Gorilla, took much interest this fall in building a “nest” in the leaves that blew into her out-of-doors enclosure at the Great Apes House. Gorillas in the wild build simple nests or sleeping platforms when a family group halts for the night.

Zoological Park Miscellany

During the last few years we have supplied Tiger cubs to many zoological parks in this country, but the first international shipment was made in November when one of last year’s cubs was sent to the Taronga Zoological Park in Sydney, Australia. With it went 2 Eastern Striped Skunks, 3 Ring-tailed Monkeys, 4 Armadillos and 2 Black Squirrels to help balance our account for an exchange shipment received from Sydney. This included a pair of young Dingos, a Great Gray Kangaroo, an Agile Wallaby, a Wallaroo, 2 Tawny Frogmouths, 3 Satin Bower Birds, 2 Giant Laughing Kingfishers and a Wedge-tailed Eagle . . . Consuls General from 38 countries visited the Zoological Park in mid-October for a luncheon followed by a tour of the major buildings . . . Dr. Goss, Assistant Director and Veterinarian, was elected as Vice-chairman of the American Association of Zoological Parks and Aquariums in Baltimore in October . . . Dr.



Harry A. Charipper, Professor of Biology and Head of the Department of Biology of New York University, has been appointed Research Associate in Histology on the staff of the Aquarium by action of the Executive Committee . . . Fred Taggart, an employee of the Zoological Park since 1911 and Head Keeper of the Reptile Department since 1940, retired on November 1 . . . The fall migration normally brings many interesting birds through the Zoological Park, but seldom into its buildings. This year a Wood Thrush entered the Main Bird House and was captured as it was fluttering around a Bird of Paradise compartment. — W.Br.

PUBLICATIONS OF INTEREST

THE ANIMAL KINGDOM. By George G. Goodwin, Charles M. Bogert, Christopher W. Coates, James W. Atz, E. Thomas Gilliard, Dean Amadon and John C. Pallister. Edited by Frederick Drimmer. 2062 pp., many illus. 3 vols. Greystone Press, New York, 1954. \$17.50.

There is no law that says natural history has to be grim, and the editor, writers and publisher of "The Animal Kingdom" have taken advantage of this loophole to give us a spritely and readable, informative and for all practical purposes complete Natural History of mammals, birds, reptiles, fishes, insects and other invertebrates. These three volumes come as near being a between-covers counterpart of our own Zoological Park

Question House as any single set of books can; they answer firmly and at suitable length the great bulk of questions that people are likely to ask about wild animals. Disregarding the minor slip-ups inevitable in any work of 600,000 words, the information is up-to-date and above all lively. Volume One, opened at random, disclosed these sub-heads under The White-toothed Shrew: "A Cruel Custom," "Stench Into Perfume." And on the opposite page, under Indian House Shrew: "Money Mouse," "Smallest Mammal on Earth." It is pleasant to report that the long section on fishes was written by our own Christopher W. Coates and James W. Atz — and that it is by no means the least engaging section — and that our own Staff Artist, Lloyd Sandford, drew the illustrations for the Fish section. They are consistently the best black-and-white drawings in the set. — W. BRIDGES

New Members of the New York Zoological Society (Between September 1 and October 31, 1954)

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Mrs. Frederick J. Steinhardt
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We're Busy as Beavers . . .

GETTING READY FOR THE NEXT YEAR'S FUN

Annual Members' meetings

January 25 and 26, 1955.
(More formal notice later)

Matinee — January 25, 1955

for children members and
members' children.
(More formal notice to come)

Garden Party

in the spring at
the New York Zoological Park
(Bronx Zoo)
(Date to be announced)

New animals

right along
(Watch for their announcement in
Animal Kingdom)

There will be something doing at
the **New Aquarium** (building started
last week in October)

**So Keep Up Your Membership,
Give Memberships as Christmas Presents,
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or better,
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